

ANNEX 1:
**Description of the
Action**

October 2017

B

List of Acronyms

ASR	American Sugar Refining
BGA	Banana Growers Association
BAM	Banana Accompanying Measures
BSI	Belize Sugar Industry
EU	European Union
ISFM	Integrated Soil Fertility Management
IICA	Inter-American Institute for Cooperation on Agriculture
MED	Ministry of Economic Development
NATS	National Agriculture and Trade Show
PAGODA	Pillars Assessed Grant or Delegation Agreement
SFA	Special Framework of Assistance
UB	University Of Belize

1. SUMMARY OF THE ACTION

Title of the action:	Productivity enhancement of banana farms through integrated soil fertility management in the Banana Belt Area of Belize.
Location(s) of the action:	Belize, Stann Creek and Toledo Districts
Total duration of the action (months):	18 months
EU financing requested (amount)	2,023,197 EUR
EU financing requested as a percentage of total budget of the Action (indicative)	Total cost of the Action: 2,302,023 EUR EU: EUR 2.023.197 – 87,88% - fuente 1 BGA: EUR 150.000 – 6,52% - fuente 2 UB: EUR 8.000 – 0,34% - fuente 3 IICA: EUR 120.826 – 5.25% (in-kind contribution)
Objectives of the action	Overall objective: The overall objective of the project is to foster social and economic development, leading to the reduction of poverty, focusing on workers, their families and communities in the banana belt area of Belize. Specific objectives: The project purpose is to increase the efficiency of banana production.
Target group(s)	22 farms and 10 banana producers
Final beneficiaries	Shareholders in the banana sector, communities in the banana belt and the country of Belize
Estimated results	The action seeks the following results: R1. Increased knowledge of farmers and the Banana Growers Association (BGA) in Integrated Soil Fertility Management (ISFM) R2. Increased soil fertility in the banana sector for improved productivity R3. Enhanced capacity of the University of Belize's micro-propagation laboratory for improved production of banana planting material
Main activities	Result 1: R1-A1: Technical capacity building R1-A2: Field demonstration plots for Integrated Soil Fertility Management Practices Result 2: R2- A1: Land preparation including clearance, fallowing and soil de-compaction;

	<p>R2- A2: Soil conditioning to increase soil organic and mineral contents, R2- A3: Farmer training, knowledge management R2- A4: Monitor the soil fertility management program</p> <p>Result 3: R3- A1: Strengthen UB's laboratory capacities in banana variety diversification and procedures for developing elite banana lines, plant disease diagnosis, development of tissue culture of other commodities.</p>
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2. DESCRIPTION OF THE ACTION

2.1 Background

This action is being developed within the context of the Banana Accompanying Measures (BAM) 2013 program to provide financial assistance to the Belize banana sector, more specifically the Banana Growers Association (BGA). The BGA includes 22 banana farms with 6,893.6 acres under production in the Toledo and Stann Creek Districts. Since 1991, the annual production has increased from 21,000 to 70,000 tons in 2003-2005 and to 100,000 tons today (average 2013-2015). A drop to 70,000 T was experienced in 2016 due to weather conditions (Flood and hurricane).

There is need for sector adjustment to the new market conditions derived from the reduction in banana import tariffs and eventual erosion of the preferential margins that the group of banana exporters from the ACP countries had on the European market. The European Union provided support to the banana sector through the Special Framework of Assistance (SFA) totalling € 24.6M. During this programme's implementation, between 1999 and 2011, the growers managed to increase their yield by 25%, increasing from 15 tonnes to 18 tonnes acre. The progress made by the growers during that decade was not enough to maintain and increase yield.

There remain inefficiencies in the production practices hindering further improvements in yields. Constraints to yield improvements include inadequate application of good agronomic practices such as adequate land preparation, land clearing activities, fallowing, rehabilitation of soil fertility (structural, chemical and biological) together with appropriate drainage and effective irrigation systems, allowing improved fertigation systems.

Currently, the industry cannot source quality meristems in country and is required to import from Honduras. However, the University of Belize (UB) was supported to develop a tissue culture lab under the SFA. This provided for infrastructure/equipment and provision of inputs for the set-up of a laboratory at the University of Belize (UB) for production of high-

quality meristems. It also provided much of the larger equipment for the lab (including autoclave, laminar flow cabinets, oven and light banks) after which the UB invested significantly in re-modelling the laboratory building and purchasing the supplies and equipment required to make it fully operational. As a result, UB developed the necessary protocols to produce sugar cane commercially, and the project will provide a small amount of funds to support the efforts of the UB replicate this effort for banana meristems (produced through micro-propagation). The aim is to build the capacity of the UB to produce the banana meristem for the industry with the quality that the industry current imports from Honduras and that it is also cost effective.

The Banana Growers' Association (BGA) and the University of Belize(UB), have both committed to co-finance, in cash, Euro 150,000 and 8,000, respectively, to the execution of the corresponding project activities. IICA will be contributing to the project a sum of Euro 120,826 in-kind for the technical support and execution of the project.

2.2 Complementary interventions

The actions under this project are complementary to the actions under Result 1 of the BAM 2012, which sought to increase the banana production and decrease environmental impact of the industry.

It is also complementary to Result 2 & 3 of the BAM 2013 allocation for Belize, which seeks to improve economic diversification for rural communities and improve quality of and better access to better social services respectively.

2.3. Problem Analysis

One of the main problems facing the banana industry in Belize is a decrease in productivity due primarily to declining soil fertility/health. Banana farms in Belize suffer from varying degrees of soil compaction and high soil acidity (low pH) levels, and nutrient depletion that leads to soil degradation. Pest and disease infestations are also prominent in the hot and humid environment of Belize. These conditions affect the productivity of commercial banana hybrids cultivated on the farms whose average current yields range between 12.7 to 16.4 tons bananas per acre, well below yields of some competing banana producing countries of 20 to 33 tons per acre. The productivity of banana is strongly dependent on and constrained by soil fertility levels. In Belize, banana production is done on highly weathered and generally compacted and infertile soils (class IV) with low organic matter content (<2.5%, minimum recommended is 3.5%) and pH (<5.4, recommended range is 6-7.5), low inherent soil nutrient stocks and in some cases shallow top soil layers (< cm) (Dominique 2014). Given the nature of this low soil fertility complex (low organic matter content, pH, compaction, shallow top soil) a holistic and integrated approach that builds the capacity of farmers and technicians to diagnose general and site-specific problems, monitor, and evaluate the impact of interventions/practices on a more real-time basis are needed.

Other contributing factors to current productivity levels in Belize includes the inherent characteristic of soil (soil types), poor soil management practices and number of years under cultivation. Farmers can help improve soil fertility by adopting improved agricultural practices, but they often lack the necessary expertise, skills and resources to do so effectively. This problem is compounded by inadequate support services particularly diagnostic services that can provide valuable scientific fact based information to address issues of soil fertility and management.

Farm productivity issues can be addressed with Integrated Soil Fertility Management (ISFM) techniques that promote efficient and effective use of inorganic and organic inputs, improved germplasm, combined with good agronomic practices such as fallowing and the use of cover crops. This project proposes and is designed to address or focus specific issues of soil fertility management identified as important by farmers and validated as a priority through expert technical assessments, to result in maximum potential impact. These issues are: 1. Increase in organic matter and de-compaction of soil; 2. Introduction of cover crops and fallow; 3. Compost and microbial life stimulation; 4. Increase the soil pH; 5. Allow for rapid real time in-field soil testing and strengthening of laboratory diagnostic testing capabilities; 6. Establishment and refurbishment of drains on the farms and 7. monitoring and evaluation program for data gathering and subsequent decision-making.

A scheduled replanting program and the adoption of a ten-year banana fallow cycle are expected to boost banana yields. This will also assist farmers in maintaining disease-free soil bed, and rejuvenated soil profiles. The technical collaboration with the University of Belize (UB) to upgrade its laboratory facility ensures a strengthening of the diagnostic capabilities to provide soil analysis services to farmers as well as the production of disease free planting materials that can be readily available when needed.

This project aims to build the technical capacity of the banana farmers and technicians by jointly designing and implementing field research plots to produce best practices in banana production to improve soil management through theoretical and practical training sessions and on-farm demonstration. In addition, material will be provided to support the increase of the farm soil fertility for optimal yield increases. The project will also strengthen the diagnostic and service delivery capabilities of the laboratory of the University of Belize.

2.4 Approaches and Methods

In this project, Integrated Soil Fertility Management (ISFM), which refers to the systematic, efficient and effective use of mineral fertilizers, organic inputs and improved germplasm combined with good agronomic practices, such as fallowing, cover crops and soil drainage (Fairhurst, 2012) will be used as a more holistic and sustainable approach to improve soil fertility/health, and maximise agronomic use efficiency and crop productivity. ISFM strategies will focus on the building of soil nutrient and microbial capital by better managing available organic resources and increasing nutrient use efficiency via agronomic practices and the use of improved and/or available germplasm. Increased water use efficiency is often an additional benefit of ISFM. Organic matter are rarely substitutes for mineral fertilizers

due to their low or rather inaccessible nutrient content and they are usually not available in sufficient quantities. However, organic matter is a crucial soil conditioner, which enhance mineral fertilizer efficiency and acts as environmental “security” devices. That is, as they improve storage and recovery of nutrients. They profoundly affect the activities of microflora and microfaunal organisms, promote good soil structure improving tilth, aeration, increase buffering exchange capacity of soils, retention of moisture and thus help reduce leaching and losses that are harmful to the environment. Therefore, they decrease the risks related to the use of mineral fertilizers.

The ISFM approach, which consists of an exploratory, training-experimentation-extension and a scaling-up and -out stage, has been successfully used to enhance banana productivity in several African countries including Sub-Saharan Africa, Uganda, Democratic Republic of Congo, Côte d’Ivoire and Nigeria (Tadele 2017 and Vanlauwe et al 2015). Each stage consists of a phase called DATE: Diagnostic (D), Action planning (A), Trying out (T) and Evaluation (E). The exploratory stage, which consists of farm and crop system analysis has already been done in Belize and the results were used to develop this project. During the exploratory phase, farmers identified their priority needs and technical reports (which included results of soil and tissue analysis) on the industry and each farm were reviewed to corroborate and prioritize these needs. In accordance with the ISFM approach, the technical reports were also used to identify the general soil fertility problems affecting all farms while determining the differences in severity levels across and within farms. Farm visits were undertaken to further validate soil fertility issues and their severity across and within farms. The results of this exploratory phase showed that the main issues to be addressed are:

- Improving the technical capacity of the farmers and technician to diagnose general and site-specific soil fertility problems and monitor and evaluate the impact of interventions/practices on a more real-time basis using rapid in-field soil testing.
- Increasing organic matter content in soil
- De-compacting soil and improving on-farm drainage
- Increasing soil pH levels
- Increasing soil fertility and conservation by using fallowing systems and cover crops.

As such, the proposed project is based on two premises:

- (1) Sustainable production of banana requires implementing of integrated soil fertility management (ISFM).
- (2) Addressing soil-related constraints requires not simply increasing the use and/or access to fertilizers or organic soil amendments, but - fundamentally – enhancing capabilities of farmers and technicians to diagnose problems and systematically develop/implement, monitor and evaluate interventions at a farm and industry level.

2.5 Logical Framework

The detailed logical framework is contained in Annex 1 of this proposal.

2.6 Objectives of the action

2.6.1 Overall objective: The overall objective of the project is to foster social and economic development leading to the reduction of poverty, focusing on workers, their families and communities in the banana belt area of Belize.

2.6.2 Specific objective: The project purpose is to increase the efficiency of banana production.

Stakeholders in the banana sector agree that solutions to the sector development challenges, require a participatory global and collective response that integrates and builds on existing initiatives and articulates an explicit and long-term strategy to address the situation and developmental needs of banana producers. This consensus recognizes that focused agronomic intervention will allow for the determination of effective support in five critical needs:

- (i) Soil de-compaction
- (ii) Refurbishment and establishment of drains
- (iii) Establish cover crops and fallow
- (iv) Incorporation of soil amendments (organic and inorganic)
- (v) Replanting for the rehabilitation of farms

The Action will take steps to strengthen the capacity of technicians of the BGA, the Ministry of Agriculture, banana producers and their farm managers in the application of scientific principles and practices in ISFM. These five components will be complemented by a sixth aspect aimed at strengthening of the UB to supply healthy planting material of quality and competitive prices.

- (vi) Technical assistance to the University of Belize

The Action will contribute to the strengthening of the technological capabilities of banana producers. This will help to transform their systems of production to achieve improvements in productivity and competitiveness on their enterprises that affect their livelihoods. The Action will contribute to enhance operational efficiencies through the validation and adoption of improved and appropriate technologies and practices within the framework of Integrated Soil Fertility Management.

2.7 Results:

The impacts of these actions will contribute to:

1. Increased resource efficiency of the banana industry.

2. Increased knowledge capacities of farmers and the Banana Growers Association (BGA) for Integrated Soil Fertility Management (ISFM).
3. Enhanced capacity of the University of Belize micro-propagation laboratory and nursery facilities for production of improved planting material and soil diagnosis services.

2.8 Components and Activities

The specific components and activities are as follows:

2.8.1 Component 1: Technical Capacity Building

Activities:

2.8.1.1 Upgrading farmers and technicians agronomic and diagnostic skills under the framework of good agronomic practices

Farmers are generally technically equipped to deal with one soil fertility issue at a time. However, the complexity and severity of soil fertility problems that exist in the banana industry necessitates an enhancement of the technical capacity of the farmers and technicians to address these constraints in an integrated and more systematic manner, which allows him/her to monitor and measure the impact of interventions. More so, farmers and technicians need to be informed and trained in rapid-field test analysis systems and key indicators of soil and plant health.

The aim of this activity is to improve the technical capacity of banana farmers and technicians in integrated soil fertility practices and techniques, which can be used to address their present soil fertility challenges. The activity focuses on training groups with a combined total of thirty-four (34) - farmers, farm managers and technicians from the BGA and the Ministry of Agriculture on the ISFM approach, which includes soil fertility management practices, soil and crop production and rapid-field soil (using soil kits), and plant test analysis under the framework of good agronomic practices. A total of eight (8) separate training sessions (in-class and on the field training), which focuses on understanding and remedying the soil fertility issues of low organic matter content, low pH, compacted soils, shallow top soil, composting, soil conservation and improving on-farm drainage will be done over the course of the project. In addition, the IICA technical specialists will provide support at the inception and at the end of the project. During the training, the farmers will use soil kits and other diagnostic tools to establish a baseline or reference point, as well, as use of tools and machines for the management of the soil de-compaction and drainage.

2.8.1.2 Establishment of field demonstration plots

Demonstration plots will be used in ISFM training to teach how different soil fertility practices and techniques are done and can be integrated to achieve maximum effect. A total of twelve (12) demonstration plots will be established on banana farmers' land to facilitate the ISFM training. These plots will be established on farmers' land according to the severity

and heterogeneity of the soil fertility problem that exist. Strategies and practices to address all the aforementioned soil fertility problems will be demonstrated on these plots. A total area under demonstration plots will be 7 acres (2 sites at 1 acre each for cover crops/fallow, 2 sites at 2 acres each for evaluation of the germplasm and 8 sites at 500m² for the other soil fertility problems). Two demonstration plots will be used to compare the performance of tissue cultured banana plants produced by University of Belize Laboratory to that of planting material imported. The demonstration plots form the first slate of the scaling-up phase, where results will be used to recommend and implement strategies on a larger farm-scale. The aim of the demonstration plots is to demonstrate the use of soil amelioration technologies to improve soil health on banana plots.

2.8.2 Component 2: On Farm Soil Improvement and Conservation

The on-farm soil improvement and conservation component, represents the scale-out phase of the ISFM approach, where the most effective soil fertility practices as seen from the demonstration plots are implemented on a large scale on farmers' farms. This component is not for experimental or teaching purpose but reflects the use of successful soil fertility practices with implications for productivity on a farm and industry level.

Activities:

2.8.2.1 Soil De-compaction

Soil compaction is a major impediment to root and plant growth in the banana. Most of the soils around the plants show compaction levels reaching 3.5 to 4.5 kg/cm² when it should be below 2.5 kg/cm² to allow proper root development. The BGA received mini excavators under the BAM 2012 grants to assist in loosening of the soil and drainage. The Banana sector has a total of 15 mini excavators distributed between BGA (5) and farmers (10). It is expected that the equipment from BGA will be provided in kind to the farmers for de-compaction of soils. Soil de-compaction will be carried out based on a priority basis dependable on severity of compaction. A total of 560 acres will be de-compacted.

2.8.2.2 Refurbishment and establishment of drains

This activity will be done to effectively remove excess water from farms and encourage more effective root growth and nutrient uptake. The drainage will also improve soil aeration, a necessary condition for effective decomposition of soil organic matter. Drainage work will be undertaken on 22 farm holdings over 560 acres. The mini excavators, from BGA and farmers, will be used to address this issue. However, some tools such as shovels, spades, forks, hoes etc. will be provided to farmers that can only do this work manually. Drain works will be done according to severity and priority needs of farmers. These activities will be coordinated and executed in collaboration with the BGA's current ongoing program to enhance and expand on this activity.

2.8.2.3 Establishment of cover crops and fallow

The establishment of cover crops and fallow system will be done as a means of resting and rejuvenating the soils with organic matter and to reduce soil erosion and compaction. It will also be done to break disease cycles and to mitigate nematode populations. Three cover crops will be used on a total of one thousand five hundred (1500) acres of established fields for 10 farms. Cover crops will mainly consist of leguminous plants (wild peanuts, *Paspalum notatum*, mucuna, *Desmodium ovalifolium*, etc.) that fix atmospheric nitrogen into soil through rhizobium bacteria and make it available for plant use, and other beneficial crops like forages.

It is expected that 2.5% of the actual banana area will be fallowed per farm (for a total of 172 acres of the total areas under production). It is not possible to do more since the growers already apply a chop-back technique on 15% of their land (this consists in chopping down 15% of the land in May and June in order to get more fruits at the beginning of the year when prices are high). Disease-free banana planting material will be available to farmers for planting after fallowing.

2.8.2.4 *Incorporation of Soil Amendments (organic and inorganic material)*

The mean soil organic content in the banana farms is 2.4% and it is recommended that it be at a minimum value of 3.5%. However, the soil conditions and bad management practices in the Banana Belt do not permit the production of enough biomass to replace the soil organic content that is lost every year by mineralization. Organic matter is crucial as a soil conditioner to improve nutrient use efficiency. However, in the banana belt area, a readily available source of organic matter, in sufficient quantities, to have a significant impact on the soil's physical characteristics, has not been identified. A primary source of organic material has been identified in the sugar industry as bagasse ash which the sugar mill (BSI/ASR) has entered into an agreement with the Government of Belize to provide free of cost. This will be used as part of the integrated soil fertility management program. Two hundred and ten (210) tons of bagasse ash will be transported from the sugar mill and incorporated in the soil of ten (10) farms (at different rates according to the severity of the problems). Bagasse ash application on its own will not replenish soil fertility. Therefore, as part of the integrated soil fertility program, the project will supply inorganic fertilisers to be applied in five hundred and sixty (560) acres of (22) farms at different rates according to needs. This amounts to eight thousand, nine hundred and sixty (8,960) bags of fertiliser. The cost of bagging and spreading of the organic material on existing plots will be borne by the growers. This activity will also aim at reducing soil acidity which inhibits optimal nutrient uptake and utilization by the plants. The intervention will seek to increase soil pH levels to at least 5.5. To achieve this, farmers will be supplied with 8,960 bags Triple Cal product for application to their soil. These are important first steps in increasing the fertility of soil, while other practices such as the incorporation of organic matter is being undertaken to increase use efficiency.



Twenty-two (22) soil testing kits will be provided to farmers and they will be trained in the use of these kits so that they can monitor the fertility of the soil where the demonstration plots are established. This will allow all farmers (10) and technicians (8) to undertake rapid real time soil and plant test that will facilitate calculations for fertilizer applications as well as the monitoring and evaluation of project activities geared at increasing soil fertility. The following will be procured: a) 22 soil kits, b) 2 soil master kits; c) 34 environmental kits; d) 3 Compost maturity test kit; e) 5 Compost refill kit; f) 24 Compost probes; g) 2 refill soil kits.

A total of twelve (12) demonstration plots on 7 acres will be established on farm lands through an agreement with the Banana Growers Association.

2.8.2.5 Replanting for the rehabilitation of farms

Securing and distribution of disease-free planting material will be carried out to reduce pest and disease infestation and thus improve productivity. Cultured banana plants for 35 acres will be purchased to increase planting density since some of the plots are under populated (28,875 meristems at 825 plants per acre).

2.8.3 Component 3: Knowledge Management

The knowledge management action is geared towards documenting and capitalizing upon the knowledge developed during implementation, as well as information from other external sources which will be useful to strengthening the capacity of farmers and technicians.

Activities:

2.8.3.1 Experience Capitalization/Knowledge Transfer

This action will consist of identifying experiences, validate and document through video and written reports of lessons learned, best practices used and farmer and technician experiences. Tech Packs or Information brochures and manuals on soil organic matter, soil pH, cover cropping, soil and water conservation techniques and practices will be produced and disseminated to farmers and technicians. This will allow producers to possess relevant information of all the ISFM practices carried out under the project and can be used as reference for future projects.

2.8.3.2 Farmer Exchange Visits

This action will expose select farmers to local and foreign experiences in banana production under integrated soil management approaches, particularly as it relates to low cost, low inorganic input models. It will allow farmers, to focus time and attention on a topic, learning by doing, sharing ideas, and assess the relevance of new approaches. It will enable groups of 15 - farmers and technicians to network and share experiences with their peers from other jurisdictions on the best practices, management of their farms and methods used to ensure and maintain high yields. Farmers will have a first-hand experience visiting farms with advanced producing techniques in banana culture in neighboring countries in the

region (countries like Honduras, Nicaragua and Costa Rica) and will benefit by planning for future use the practices they observe.

2.8.3.3 University Interns

This action will consist of inviting interested interns to participate on the execution of activities as proposed by some of the farmers. Farmers expressed their interest on having interns from universities such as Zamorano University from Honduras, the Earth University from Costa Rica as they possess the necessary skills and are formed in a demanding environment which challenges them with real life scenarios. The interns will focus on carrying out activities programmed by the farmers to achieve positive outputs and objectives on the farm.

2.8.4 Component 4: Technical Assistance to the University of Belize (UB)

This action will consist of two related interventions geared towards improving the laboratory and plant nursery and hardening infrastructure of the University with the objective of acquiring Lab certification geared toward the production of quality banana meristems.

2.8.4.1 Procurement of Infrastructure modification/renovation for installation of new Laboratory Equipment, Materials and Supplies

This activity will attend to the relevant infrastructural modifications and renovation of laboratory facilities including replacement of lab roofing, storage space and water storage distribution system, in order to facilitate installation of the new equipment such as autoclave, analytical balance, multitier walk-in growth chamber and materials including consumables (reagents and chemicals for preparing media).

Although the University had received funding from the EU in 2010 through a previous financing agreement, the humidity and a problem with termite infestation that Central Farm has battled with over the years, have affected the infrastructure of the lab where the meristems are produced. All wood structures will be replaced with zinc or metal. There is also need to expand the lab to increase much needed proper storage space and upgrade of the current water storage distribution system. Equipment such as the autoclave also need to be replaced since the current autoclave has broken down several times and since it was a European based equipment, spare parts are not available in Belize and have to be shipped from Spain, making it costly to repair. Therefore, where possible, an effort will be made to procure equipment manufactured in the region where spare parts are more accessible and less costly.

This new investment through the project will significantly upgrade the laboratory to ensure the successful production of adequate banana meristem for the Banana sector.



2.8.4.2 Lab Certification Program

This activity will seek to bring the Laboratory facilities into compliance with international certification standards.

To achieve this task, the existing plant nursery and hardening facilities will be fully renovated and upgraded for the purpose of producing quality banana meristems and will permit the UB to provide soil and plant diagnostics to farmers and the production of disease free planting material. Relevant training for UB staff in operational procedures in the use and maintenances of new laboratory equipment will also be done.

3. PROJECT SCHEDULE

Project Implementation Period: December 1, 2017 to May 30, 2019 – 18 months

Integrated soil fertility Management	Timeline (quarters)					
	I	II	III	IV	V	VI
1. Technical Capacity building						
1.1 Upgrading Farmers/technicians agronomic/diagnostic skills						
1.2 Establishment of field demonstration plots						
1.3 Maintenance of demonstration plots						
2. On-farm soil amelioration and conservation						
2.1 Soil Decompaction						
2.2 Incorporation of Inorganic Fertilizer						
2.3 Incorporation of tripleCal						
2.4 Incorporation of sugarcane bagasse						
2.5 Establishment of cover crops and fallow system						
2.6 Refurbishing of drains						
3. Supply of planting materials and inputs						
3.1 Procurement of planting materials and inputs						
3.2 Procurement of soil and composting diagnostic kits						
4. Knowledge management						
4.1 Experience capitalization and knowledge transfer						
4.2 Farmer exchange visits						
4.3 Student Internship						
5. Technical assistance to UB						
5.1 procurement of laboratory equipment, materials & supplies						
5.2 Infrastructure modification/lab renovation						
5.3 Lab certification						
5.4 Upgrade renovation of nursery and plant hardening structures						
5.5 Training in operational procedures						
6. Project coordination						
6.1 project unit staff						
6.2 Project overhead & logistics						
6.3 Project vehicle & equipment						
6.4 Communication & visibility (Internet, flyers, brochures, etc)						
7. Monitoring and Evaluation						
7.1 Project Monitoring						
7.2 Project evaluation						
8. Contingency (3%)						
Internal cost recovery(ICR) (7%)						

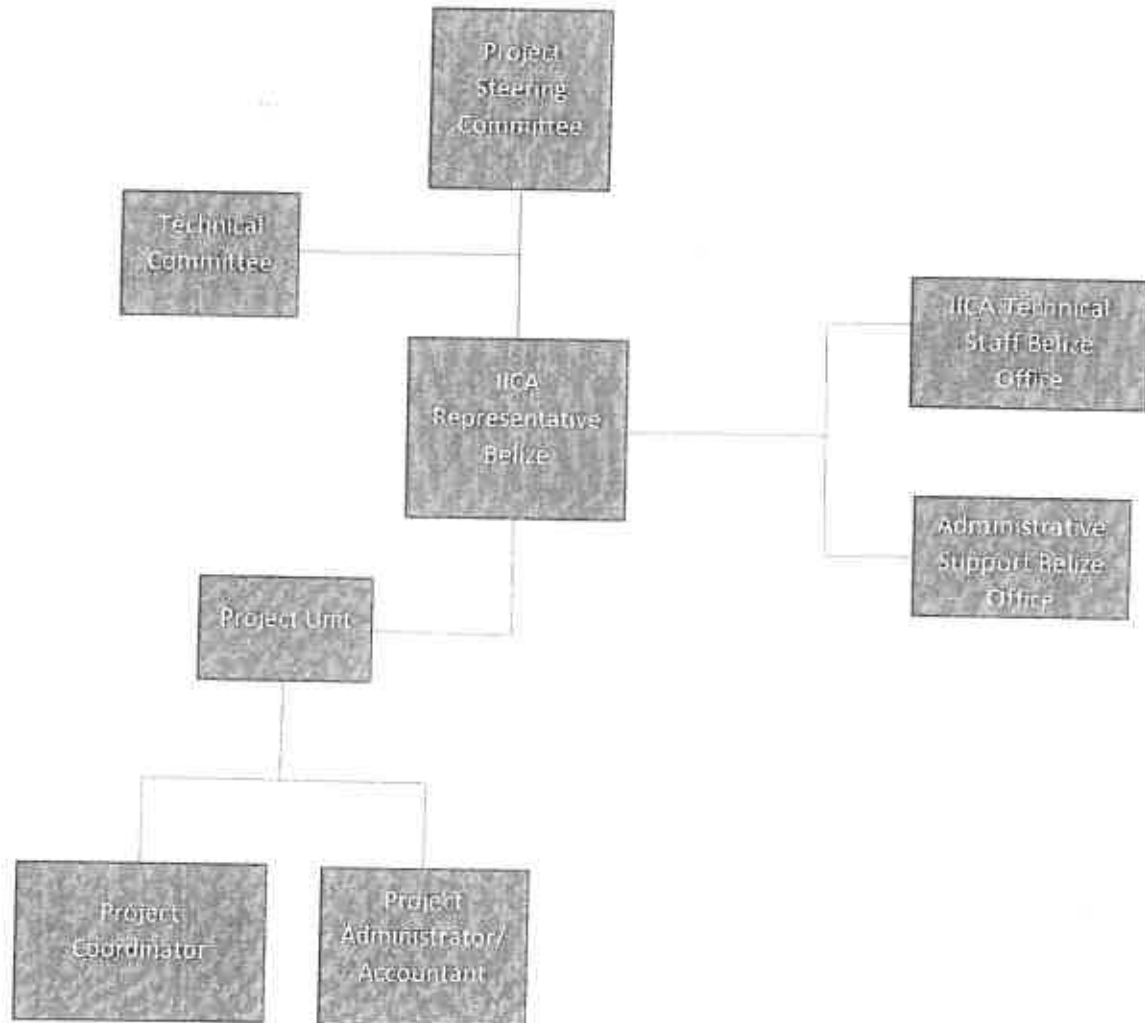
4. PROJECT BUDGET

The detailed budget is contained in Annex 2 of this proposal. The Belize dollar is the official currency in Belize and for several decades this has been tied to the U.S. dollar at an official rate of two BZ Dollars to one US dollar. Since IICA headquarters uses the US dollar for reporting and also due to the fact that most of the services to be procured through the project will be done in Belize, the region and the USA, the budget was prepared in US dollars. This was then converted to Euros. The

exchange rate used was 1 € = US\$1.1173. This rate was based on the information obtained from the Info Euro website at June 2017 when the budget was first developed. The exchange rate for the project will be the one in effect at the moment of each disbursement.

The overall cost of the Budget is EUR 2,302,023 to which the EU's contribution is EUR 2,023,197. The BGA will contribute in cash EUR 150,000, the UB EUR 8,000 also in cash and IICA's in-kind contribution will be of estimated EUR 120,826.

5. PROJECT ORGANIZATION/MANAGEMENT



The technical and administrative staff of the IICA office of Belize will provide oversight of the project. Technical and administrative support will also be provided by the Cooperation & Development Project Officer from IICA's Headquarters.

5.1 Project Coordination

A Project Coordination Unit will be established for the day to day implementation of the project. A Project Coordinator and an Administrator/Accountant will be hired to provide support to the IICA Belize office for the overall implementation of the project. The IICA

offices will assign the National Technical Specialists to provide technical support to the project. The Project Coordinator will be responsible for coordination and implementation of the project and will report directly to the IICA Representative. The Project Coordinator will be stationed in Independence, in the Banana Belt region. The office space will be provided by the BGA.

A Project Steering Committee will be established to serve as an advisory board and be set up to oversee and validate the overall direction and actions of the project. This committee will be chaired by the IICA Representative and will comprise of representatives of BGA, NAO in the Ministry of Economic Development, Ministry of Agriculture, UB, and an EU representative. The members will meet every 4 months (3 times per year). (Annex 4)

In addition to the Project Steering Committee a Project Technical Committee will be established to assist the project coordinator in monitoring and reviewing the technical and operational progress of the project and to provide technical assistance and advise in addressing specific technical issues of the project. The Technical Committee will comprise of technical officers and specialists from BGA, UB and IICA and the members will meet monthly. It will be chaired by the Project Coordinator. (Annex 5)

6. PROJECT MONITORING & EVALUATION

The Project Coordination Unit will have a monitoring system that allows for continuous technical and financial monitoring during the implementation of the project. This will form the basis for the elaboration of all progress and final reports and input for the scheduled mid-term and end of project evaluations. The IICA Belize office will assume full responsibility for oversight, for technical and financial monitoring of the project, with the support of the project coordinator and the administrator/accountant hired to provide support to the project. IICA Technical Specialists from other member country representatives and technical units will also be engaged in the project monitoring exercises during the implementation. A total of 7 trips have been programmed to Belize for at least 2 to 3 IICA technical specialists from the region (Caribbean and Central America) over the course of the life of the project. These will include highly qualified specialists to support both the technical and administrative aspects of the project which are not currently available in Belize. This represents a significant added value and cost savings to the project as it has eliminated the need to hire external consultants. The project will only cover the cost of flight, meals and accommodations for the technical specialists traveling to Belize.

7. REPORTING

The reporting carried out will follow the EU's rules, procedures and regulations as stipulated in the BAM 2013 Finance Agreement and the signed PAGO DA Agreement. The IICA Belize Office will elaborate and submit technical and financial progress reports to the National Authorising Office within the Ministry of Economic Development (MED), the Ministry of Agriculture and the EU Delegation in Jamaica. The EU Delegation in Jamaica will approve all progress and final reports.

8. RISKS

There are two major risks identified for the project. One is the possibility of adverse weather conditions that may affect project activities, which are predominantly on farm and the other risk identified is associated with farmers losing access to international markets, both of which could reducing the farmer's capacity of liquidity to follow through with the activities proposed.

9. PROJECT SUSTAINABILITY

Many of the farmers recognize that they need to change their current practices in the industry to become competitive in a global market. However, part of the reason they have not been bold in taking the necessary steps as those described in this project has been due to low economic growth to allow them to re-invest in new and more sustainable activities. This project will allow the producers to jump start this process and move towards increased economic growth to continue practicing the activities they will learn under the ISFM system that the project will introduce. In this regard IICA will continue to engage, dialog and strengthen its linkages with the banana producers to provide follow up activities of sustainable soil fertility management through technical assistance and cooperation actions in Belize aimed at improving productivity in the banana belt area. IICA has a vast network of experienced experts in the areas of technology and innovation for agriculture, agricultural health and food safety, agribusiness, agricultural trade, rural development and training, international trade and trade negotiations, strategically located both in the country offices and at its central Headquarters in Costa Rica. The IICA's wealth of experience and good track record as a technical cooperation agency in the Region and its network of offices in the Caribbean and Latin American countries provide on-the-ground capacity for implementation of any future related projects. As such, the IICA Belize office has the capacity to further engage its experts in banana production in particular phytosanitary aspects of banana production and integrated soil management including soil composting. In addition, IICA has the capacity to organize and reinforce stakeholder platforms to facilitate dialogue exchange and cooperation among farmers, technical specialists, policymakers and others.

The support to the University of Belize (UB) will be through the commercialization of laboratory services to the farming community and the production and sale of crops seedlings.

IICA office will continue to seek future projects to further support the Industry's sustainability and competitiveness, as we are doing in other sectors.

10. ANNEXES

Annex 1: Logical framework

Specific Objective	Intervention Logic	Objectively Verifiable Indicators	Sources of Verification	Assumptions/Risks
	The project purpose is to increase the efficiency of banana production.	10% increase over the next 3 years in banana production efficiency in the banana belt area of Belize.	Banana Growers Association (BGA) monthly reports	Adverse weather Lower capacity of liquidity due to factors out of their control (weather, markets etc.)
Results	1. Increased resource efficiency of the banana industry.	At least 560 acres of bananas benefiting from Integrated Soil Fertility Management (ISFM) techniques; At least 560 acres: - de-compacted - Drains established/refurbished benefiting from applications of organic and inorganic materials At least 1,500 acres under cover crops. At least 172 acres (2.5% of total	Banana Growers Association (BGA) monthly reports Project progress reports	Farmers adhere to recommended input application schedules and techniques; Farmers and technicians conduct soil diagnostics efficiently.

		<p>area under production) followed.</p> <p>At least 10 farmers and 8 technicians benefitting from the use of soil diagnostics kits for decision making on nutrient applications;</p>		
<p>2. Increased knowledge capacities of farmers and the Banana Growers Association (BGA) for Integrated Soil Fertility Management (ISFM).</p>	<p>At least 34 farmers, farm managers and technicians from BGA and the Ministry of Agriculture trained ISFM techniques and real time soil diagnostics;</p> <p>At least 10 farmers and technicians trained in composting technologies;</p> <p>At least 12 on-farm training demonstration plots established for organic matter, cover crop and fallow systems, and pH management and the comparison with the UB</p>	<p>At least 34 farmers, farm managers and technicians from BGA and the Ministry of Agriculture trained ISFM techniques and real time soil diagnostics;</p> <p>At least 10 farmers and technicians trained in composting technologies;</p> <p>At least 12 on-farm training demonstration plots established for organic matter, cover crop and fallow systems, and pH management and the comparison with the UB</p>	<p>Banana Growers Association (BGA) monthly reports</p> <p>Project progress reports</p>	<p>Farmers and technicians respond favorably to new technologies/training;</p>

		meristems versus the imported plant materials.		
	3. Enhanced capacity of the University of Belize micro-propagation laboratory and nursery facilities for production of improved planting material and soil diagnosis services.	Micro-propagation laboratory and plant propagation nursery renovated and upgraded.	University of Belize reports	Counterpart available complementary works Banana farmers willing to access services and planting material from UB facilities

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Annex 2: Detailed Project Budget

Budget for the Action	All Years				Year 1 - in EUR			
	Unit	# units	Unit rate (in EUR)	Costs (in EUR)	Unit	# units	Unit rate (in EUR)	Costs (in EUR)
Costs								
1.1 Salaries (gross salaries including social security charges and other related costs, local staff)								
1.1.1 Technical staff (Field labour for Demonstration plots)								
1.1.1.1 Labour for the establishment and maintenance of the 2- 1 acre demonstration plots of cover crop and fallow								
Establishment	days	60	20	1,208	days	60	20	1,208
Maintenance	days	220	20	4,430	days	220	20	4,430
1.1.1.2 Labour for establishment and maintenance of the 2 - 2 acre demonstration plots for the evaluation of the banana germplasm produced by UB and those imported								
Establishment	days	60	20	1,208	days	60	20	1,208
Maintenance	days	220	20	4,430	days	220	20	4,430
1.1.1.3 Labour for the establishment and maintenance of the 8 - 500m2 demonstration plots								
Establishment	days	210	20	4,229	days	210	20	4,229
Maintenance	days	250	20	5,034	days	210	20	4,229

Budget for the Action	All Years					Year 1 - in EUR				
	Unit	# units	Unit rate (in EUR)	Costs (in EUR)	Unit	# units	Unit rate (in EUR)	Costs (in EUR)		
Costs										
1.1.1.4 Labour for planting of banana plants for rehabilitation (35 acres at €850 per acre) includes clearing and preparation of the land, establishment of nursery, repair of irrigation systems, application of nutrients and pest controls etc.	acres	35	850	29,750	acre	18	850	15,300		
1.1.1.5 Labour for UB lab infrastructure renovations and upgrades	lumpsum	1	16,833	16,833	lumpsum	1	16,833	16,833		
Sub Total Local Staff				67,177				51,857		
1.2 Salaries local/expat/international consultants										
1.2.1 Service for land preparation of the demonstration plots (double pass-€256)	acre	7	256	1,792	acre	7	256	1,792		
1.2.2 Service for loading and transportation of 210 tones of bagasse (1 truck load = 8 tones)	trip	26	2,193	57,566	trip	26	2,193	57,566		
1.2.3 Service for refurbish/establish of drains on 560 acres	acres	560	524	293,440	acres	380	524	199,120		
1.2.4 Service for decompaction of 560 acres	acres	560	300	168,000	acres	380	300	114,000		
1.2.5 Service for the establishment of drains and subsoiling related to the replanting component (35 acres at €1800 per acre)	acres	35	1,800	63,000	acres	18	1,800	32,400		
1.2.6 Consultancy Contract for lab certification	Audit	3	8,458	25,374	audit	2	8,458	16,916		
Sub Total Consultancy/technical assistance				609,172				421,794		

Budget for the Action	All Years				Year 1 – in EUR			
	Unit	# units	Unit rate (in EUR)	Costs (in EUR)	Unit	# units	Unit rate (in EUR)	Costs (in EUR)
Costs								
1.3 Per diems for missions/travel¹ includes travel days								
1.3.1 TA Inception - start up activities (working days)	Per diem	10	250	2,500	per diem	10	250	2,500
1.3.2 TA for establishment and maintenance of demonstration plots (working days)	Per diem	6	250	1,500	per diem	6	250	1,500
1.3.3 TA to facilitate training of ISFM (working days)	Per diem	7	250	1,750	per diem	7	250	1,750
1.3.4 TA Training on Composting and Fallow (working days)	Per diem	5	250	1,250	per diem	5	250	1,250
1.3.5 TA Organic matter/decomposition (working days)	Per diem	10	250	2,500	per diem	10	250	2,500
1.3.6 TA pH Management (working days)	Per diem	5	250	1,250	per diem	5	250	1,250
1.3.7 TA Results/Demonstration (closing/close out) (working days)	Per diem	10	250	2,500	per diem			
1.3.8 Farmer exchange visit (1 trip 15 persons - Costa Rica/Honduras)	Per diem	75	230	17,250	per diem	75	230	17,250
Subtotal Per Diem Human Resources				30,500				28,000
Subtotal Human Resources				706,794				501,662
2.1. International travel								

Budget for the Action	All Years				Year 1 - in EUR			
	Unit	# units	Unit rate (in EUR)	Costs (in EUR)	Unit	# units	Unit rate (in EUR)	Costs (in EUR)
Costs								
2.1.1 TA Inception - start up activities	airfare	2	1,611	3,222	airfare	2	1,611	3,222
2.1.2 TA for establishment of demonstration plots	airfare	1	1,611	1,611	airfare	1	1,611	1,611
2.1.3 TA to facilitate training of ISFM	airfare	1	1,611	1,611	airfare	1	1,611	1,611
2.1.4 TA Training on Composting and Fallow	airfare	1	1,611	1,611	airfare	1	1,611	1,611
2.1.5 TA Organic matter/decompaction (airfare	2	1,611	3,222	airfare	2	1,611	3,222
2.1.6 TA pH Management	airfare	1	1,611	1,611	airfare	1	1,611	1,611
2.1.7 TA Results/Demonstration (closing/close out)	airfare	2	1,611	3,222				
2.1.8 Farmer exchange visit in the region (1 trip 15 persons - Costa Rica/Honduras)	airfare	15	800	12,000	airfare	15	800	12,000
2.1.9 Support farmers with 4 intern students from the region	airfare	4	800	3,200	airfare	2	800	1,600
Subtotal Travel				31,310				26,488



Budget for the Action	All Years				Year 1 - in EUR			
	Unit	# units	Unit rate (in EUR)	Costs (in EUR)	Unit	# units	Unit rate (in EUR)	Costs (in EUR)
Costs								
3. Equipment and Supplies								
3.1 Management equipment								
3.1.1. Purchase of vehicle	vehicle	1	29,536	29,536	vehicle	1	29,536	29,536
3.1.2 laptops	unit	2	2,000	4,000	unit	2	2,000	4,000
3.1.3 Camera	unit	1	500	500	unit	1	500	500
3.1.4 GPS	unit	1	900	900	unit	1	900	900
3.1.5 Video camera	unit	1	500	500	unit	1	500	500
3.2 Supplies								
3.2.1 office supplies (paper, toners, etc.)	monthly	18	271	4,878	monthly	12	271	3,252
3.3 On-Farm Soil Amelioration and Conservation								
Equipment								
3.3.1. Soil kits	unit	22	1,289	28,358	unit	22	1,289	28,358
3.3.2 Soil Master kits	unit	2	2,578	5,156	unit	2	2,578	5,156
3.3.3.Environmental kits	unit	34	43	1,462	unit	34	43	1,462
3.3.4 Soil refill kit	unit	2	1,435	2,870	unit	2	1,435	2,870

Budget for the Action	All Years				Year 1 - in EUR			
	Unit	# units	Unit rate (in EUR)	Costs (in EUR)	Unit	# units	Unit rate (in EUR)	Costs (in EUR)
Costs								
3.3.5 Compost maturity test kits	unit	3	2,150	6,450	unit	3	2,150	6,450
3.3.6 Compost refill kits	unit	5	1,435	7,175	unit	5	1,435	7,175
3.3.7 Compost (probes) monitoring kits	unit	24	158	3,792	unit	24	158	3,792
3.3.8 Materials for construction of a nursery for the replanting component (35 acres)	lumpsum	1	3,232	3,232	lumpsum	1	3,232	3,232
Inputs								
3.3.9 Fertilizer (560 acres at 16 bags per acre at €18 per bag)	bag	8960	18	160,384	bags	5470	18	97,913
3.3.10 Triple Cal (560 acres at 16 bags per acre at €13 per bag)	bag	8960	13	120,243	bags	6720	13	90,182
3.3.11 Seed material for the replanting component of 35 acres at 825 plants per acre	plants	28875	0.44	12,705	plants	14850	0	6,534
3.3.12 Total amendments for the replanting component (35 acres)	acre	35	900	31,500	acres	18	900	16,200
3.3.13 seeds for cover crops and fallow system (3 cover crops, 1500 acres at €215 per acre)	acres	1500	215	322,245	acres	1000	215	214,830
3.3.14 Small tools (wheel barrows, spades, forks, herbicide gun, pruning knife, protective gear etc.)	lump sum	1	9,711	9,711	lumpsum	1	9,711	9,711
3.4 Inputs for demonstration plots								
cover crop seeds	lbs.	40	50	2,000	lbs	40	50	2,000
fertilizer	bag	94	45	4,230	bags	94	45	4,230

Budget for the Action	All Years					Year 1 - in EUR						
	Unit	# units	Unit rate (in EUR)	Costs (in EUR)	Unit	# units	Unit rate (in EUR)	Costs (in EUR)	Unit	# units	Unit rate (in EUR)	Costs (in EUR)
Costs												
herbicide	gal	12	24	290	gal	12	24	290	gal	12	24	290
fungicide	lbs.	60	25	1,500	lbs.	60	25	1,500	lbs.	60	25	1,500
tissue culture - 800 plants per acer for 2 acres	plants	4800	0.45	2,148	plants	4800	0	2,148	plants	4800	0	2,148
triple cal - 16bag per acre for 2 acres	bag	160	13	2,080	bags	160	13	2,080	bags	160	13	2,080
3.5 UB Equipment and materials												
3.5.1 Laboratory equipment walk in-growth chamber	lump sum	1	106,507	106,507	lumpsum	1	106,507	106,507	lumpsum	1	106,507	106,507
autoclave	unit	1	16,725	16,725	unit	1	16,725	16,725	unit	1	16,725	16,725
stirring hot plate	unit	2	427	854	unit	2	427	854	unit	2	427	854
analytical balance	unit	1	3,467	3,467	unit	1	3,467	3,467	unit	1	3,467	3,467
3.5.2 Equipment for security monitoring												
	lumpsum	1	4,943	4,943	lump sum	1	4,943	4,943	lump sum	1	4,943	4,943
3.5.3 materials for nursery renovation	unit	1	11,885	11,885	unit	1	11,885	11,885	unit	1	11,885	11,885
3.5.4 materials for infrastructure renovation	lump sum	1	82,380	82,380	lumpsum	1	82,380	82,380	lumpsum	1	82,380	82,380
Subtotal Equipment and supplies				994,605								771,561
4.1 Training costs												

Budget for the Action	All Years				Year 1 - in EUR			
	Unit	# units	Unit rate (in EUR)	Costs (in EUR)	Unit	# units	Unit rate (in EUR)	Costs (in EUR)
Costs								
4.1.1 Trainings for producers and field staff (venue, meals, transportation to field etc..)	workshop	8	4,062	32,492	workshop	6	4,062	24,369
4.1.2 Training of UB staff in operational procedures	lump sum	1	1,706	1,706	lump sum	1	1,706	1,706
4.2 Vehicle cost								
4.2.1 Fuel (€67.13 per trip for 4 trips per month)	monthly	18	269	4,842	monthly	12	269	3,228
4.2.2 Vehicle insurance (€671 per year)	annually	2	671	1,342	annually	1	671	671
4.2.3 Maintenance of vehicle (€460 per service)	quarterly	6	460	2,760	quarterly	4	460	1,840
4.3 Project overhead and logistics (telephone, light, internet, etc.)								
4.3.1 Utilities (electricity, phone/internet etc..)	monthly	18	550	9,900	monthly	12	550	6,600
4.3.2 Courier services	lump sum	1	2,125	2,125	lump sum	1	2,125	2,125
4.3.3. Other expenses (computer maintenance, meeting costs, overtime etc..)	lump sum	1	6,680	6,680	lump sum	1	6,680	6,680
Subtotal Local Office				61,847				47,219
5. Other costs, services								
5.1 Knowledge Management								
5.1.1 Publications								

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Budget for the Action	All Years				Year 1 - in EUR			
	Unit	# units	Unit rate (in EUR)	Costs (in EUR)	Unit	# units	Unit rate (in EUR)	Costs (in EUR)
Costs								
5.1.1.1 Manual on best practices - 134 at €20 per copy	sets	134	20	2,680	sets	134	20	2,680
5.1.2 Experience capitalization/knowledge transfer								
5.1.2.1 Production of 2 - 15minute videos clips (€ 985 per minute)	video	2	14,768	29,535	video	1	14,768	14,768
5.1.2.2 Logistics costs for internship to support farmers	monthly	8	500	4,000	monthly	4	500	2,000
5.1.3 External audit	unit	1	8,950	8,950	unit	1	8,950	8,950
5.1.4 Visibility actions								
5.1.4.1 Signboards, banners, brochures, advertisement	lump sum	1	13,520	13,520	lumpsum	1	13,520	13,520
5.1.4.2 Events- launch, closing, 2 National Agriculture Trade Show fairs etc.	lump sum	1	20,560	20,560	lumpsum	1	20,560	20,560
Subtotal Other costs, services				79,245				62,478
6. Other								
6.1 Project monitoring (mid term and end of year evaluations, supervision of delegation staff)	monthly	18	6,160	110,880	months	12	6,160	73,920
6.2 Project management (support staff - 2 persons)	monthly	18	6,643	119,574	months	12	6,643	79,716
Subtotal Other				230,454	0	24	12,803	153,636

Budget for the Action	All Years			Year 1 - in EUR				
	Unit	# units	Unit rate (in EUR)	Costs (in EUR)	Unit	# units	Unit rate (in EUR)	Costs (in EUR)
Costs								
7. Subtotal direct eligible costs of the Action (7.5)				2,104,255				1,563,708
8. Provision for contingency reserve (3% of 7, subtotal of direct eligible costs of the Action)				55,073				
9. Total direct eligible costs of the Action (7+8)				2,159,328				1,563,708
10. Administrative costs (7% of 9, total direct eligible costs of the Action)				142,695				103,665
11. Total eligible costs (9+10)				2,302,023				1,666,708
12. Taxes								
13. Total accepted ¹¹ costs of the Action (11+12)				2,302,023				1,666,708

