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**Concept note**  
**Improving and protecting coffee production**  
**through managed pollination and**  
**disseminating biological control agents**  
**against pests and diseases**

## Background

1. This document, submitted by the Arthur Dobbs Institute, contains the summary of a concept note to elaborate a full project proposal designed to improve and protect coffee production through managed pollination and disseminating biological control agents against pests and diseases.
2. The proposal will be forwarded to the Virtual Screening Subcommittee (VSS) for an evaluation and will be considered by the Projects Committee in March 2014.

## Action

The Projects Committee is requested to consider this proposal as well as the recommendations of the VSS and, if appropriate, to recommend its approval by the Council.

## PROJECT SUMMARY

- 1. Project title:** Improving and protecting coffee production through managed pollination and disseminating biological control agents against pests and diseases
- 2. Duration:** tbd
- 3. Location:** To be determined by partners in coffee growing regions
- 4. Brief description:** To develop an integrated system of pollinator management to enhance coffee production through better, more synchronous pollination, coupled with pollinator disseminated anti-pest and anti-disease biocontrol agents.
- 5. Estimated cost:** US\$109,500
- 6. Financing sought from the Fund:** Grant of US\$97,000
- 7. Co-financing:** US\$12,500  
A grant of €7,500/year for three years (2013-2015) is already in hand. It is estimated that a further US\$100,000 over three years will be needed to execute the plan as described in this concept note. Proposals are in preparation for the Common Fund for Commodities (CFC), various non-governmental organizations and Foundations as well as with industry partners. Office facilities and some personnel costs can be provided in-kind from the International Commission on Plant-Pollinator Relations, the Canadian Pollination Initiative, and Bee Vectoring Technologies Inc.
- 8. Project Executing Agency (PEA):** Arthur Dobbs Institute in Mexico
- 9. Supervisory Body:** International Coffee Organization (ICO)
- 10. Estimated starting date:** tbd

## **Project background and commodity strategy**

Coffee is the 2<sup>nd</sup> most traded commodity internationally after oil and occupies large areas of plantations and small farms throughout the tropics. Production issues range from plant pests/diseases, benefits of insect (bee) pollination, use of biological control agents, soil fertility, agrochemicals, certification and biodiversity.

The scientific literature on the benefits of bee pollination for coffee is convincing. Robusta requires cross-pollination by wind and insects; without the latter yields are lower. Arabica is self-fertile but bee pollination enhances quantity and quality of yield. Managed pollinators, e.g. honeybees are not usually deployed, even though shown to increase yields and produce honey while doing so. Wild bees are commoner closer to forest patches than in centres of plantations where yields are less.

Coffee plants in given areas bloom together and over a short time but a problem for harvest is asynchronous ripening of berries. Hand harvesting ripe berries must take place several times. Mechanical harvesting is wasteful: unripe berries are discarded or used for inferior coffee, and require post-harvest sorting. Thus, pollination would a) improve yields in quantity and quality, and b) may improve synchronicity and uniformity of fruit-set, so reducing harvesting and sorting costs.

The innovation of now proven pollinator biocontrol agent vector technology adds another benefit to managed pollinators for crop production. Not only can yields be improved, the crop can be protected from important diseases and insect pests, separately or simultaneously, as demonstrated on crops as diverse as greenhouse vegetables, tender fruit, and some field crops. This technology seems applicable to coffee, which suffers from similar diseases and pests as other crops. The pollinator biocontrol agent dispensing system, which is attached directly to the hives, uses pesticide-free material and can be registered 'organic'. Thus, growers who may embrace the proposed system could enjoy added benefits through higher certification and prices.

## **Commodity Strategy**

This project will address the use of managed populations of honey bees and wild pollinators to effect a greater success of coffee flower pollination to achieve not only a greater quantity and quality of fruit set, but also to achieve a greater synchrony of fruit ripening to facilitate harvesting and to lower the wastage associated with picking unripe fruit. Managed honey bees would be used, simultaneously, to transfer pesticide-free pest and disease control agents to coffee flowers using proven biovectoring technology. This project will test both the biological and economic efficacy of using managed honey bees as an adjunct to coffee production in several countries, and in plantations of varying size and shade cover.

## **Project description**

**The first objective (Step 1)** is to assemble a team of experts (with appropriate knowledge relevant to coffee production) to include agronomists, applied ecologists, agricultural extension personnel, sociologists, political scientists, and from the coffee industry itself that will develop an interdisciplinary and practical strategy for environmentally compatible coffee production, trade, marketing, and consumption.

**The second objective (Step 2):** The first to second year of the project will entail site visits to selected countries (e.g. Brazil, Mexico, Jamaica, Colombia, Kenya, Rwanda, Viet Nam) to confirm where the project will take place. These visits will be preceded by extensive 'in office' analyses of each potential region's coffee industry and related characteristics pertaining to the project. It is vital to ensure that in each selected site there is a capacity for honey bee apiculture, or the ability to create it. The use of globally-standardized bee hives facilitates the attachment and use of the bio-vectoring technology to transfer disease and pest controlling agents to coffee flowers. At each site, we will determine how to deploy control and experimental treatment operations to achieve well-replicated, statistically-robust data sets for analysis. At this stage of the project, the collaboration of coffee growers, university researchers and graduate students, and governmental research departments is critical.

**The third objective (Step 3):** In further collaboration with the ICO, during year two, we will also submit funding application to the CFC and other organizations for longer-term funding of the project (three years) to continue internationally. Running parallel to the applied Research and Development (R&D) will be an emphasis on information and education (in both printed and electronic media) in cooperation with the ICO and other national bodies. A vital part of this is creating within the coffee grower communities an understanding of the biovectoring technology using apiculture and the capacity to deploy it successfully.

**The fourth objective (Step 4):** Years 2-3 will be the collection of the data from the control and experimental sites and their analysis. This will give the first indications of how effective managed honey bees are in augmenting pollination, distributing disease/pest control agents to coffee plants and flowers, and possibly achieving a greater synchronicity of fruit ripening. Should funding allow, we intend to operate this project in differing types of coffee plantations so that the geographic scale of production can be examined. Thus, the success of pollination by managed honey bees and the reduction of diseases/pests by biovectored

control agents can be measured in open-sun large-scale coffee monocultures to smaller-scale more shaded plantations. Similarly, should funding allow, we could compare the success of the proposed project in regions (or countries) where different climate and growing conditions prevail, and might influence the contributions of managed honey bees. At the same time, the project will survey and monitor wild pollinator diversity, abundance and activity with respect to landscape considerations and pollinating efficacy.

**An overarching objective:** A critical aspect of this project deals with the underlying socio-economics at the level of the coffee growers. The project has not only to be biologically successful, but must also be able to improve the economic returns to growers, both directly in terms of the yield and quality of the crop harvested, and indirectly, as when coffee grown consistent with this project's criteria qualifies for a higher rank of certification, and so sells for an intrinsically higher price. We will conduct an economic analysis of this venture, factoring in the costs of inputs, such as the costs of establishing and maintaining managed honey bee colonies, the biovectored disease control agents and their application, savings from reduced conventional chemical applications, contributions of managed pollinators to other economically-valuable crops in non-coffee seasons, savings from reduced unripe coffee fruit harvest, gains in prices from a greater quantity and quality of coffee beans, and gains from potentially a higher certification status, and costs of learning how to use the new technology, to mention a few of the criteria.

### **Project Components (Activities)**

#### **Component 1: Planning Workshops**

**Objective:** To bring the contributing and other interested parties to a one-day workshop for planning the scope and agenda for national site inspections for Research, Development and Innovation internationally in conjunction with the ICO.

**Output:** A strategic plan for national site inspections, general R&D methodology to be discussed and tailored to site-specific needs, facilities and personnel during the site inspections, plan an agenda for national site inspections within the constraints of the time tables of all concerned.

#### **Component 2: Site Inspections**

**Objective:** To refine and tailor the general R&D methodology to national and local site-specific needs, facilities and personnel in consultation with officials, researchers, extension personnel, and growers.

**Output:** Preparation of Standard Operating Procedures that will allow for international and inter-site comparisons and be tailored to site-specific needs, facilities and personnel. Preparation of plans and agendas for the execution of the planned R&D.

**Component 3:           Workshop for Major Proposal Preparation**

**Objective:** To bring the contributing and other interested parties to a two-day workshop for the preparation of a full Research, Development and Innovation internationally based project proposal (3–5 years) within two months of the presently requested funding becoming available.

**Output:** A full Research, Development and Innovation internationally based project proposal (3 years) based on the results from Component 2 (above) to be submitted probably through the ICO and Arthur Dobbs Institute to the CFC within one month.

**Project supervision, management, monitoring and evaluation**

With the tentative availability of funding from the International Union of Biological Sciences (IUBS), an invitation for a brief explanation of this project to be placed on the agenda of the ICO for its September meetings has been requested. At that time, discussions with the ICO as to how to combine the workshops for which this proposal is submitted with the Council Session of the ICO will be initiated. The expectation is that the ICO will assist, probably by letting Member countries and their representatives know that the 1-2 day workshop is planned back-to-back with its Council Session. This will allow interested parties already associated with this proposal to attend relevant portions of the Council Session and so become more familiar with the ICO while allowing Members of the ICO to participate in the planning for the site inspections. The mutual exchange will allow for the expansion of the working group, especially in areas of economics and marketing.

**Project benefits and beneficiaries**

The main and ultimate beneficiaries will be coffee producers, both large and small, and the coffee industry in general through better, possibly more efficient, coffee production within a 'greener' image for marketing. This project should also, in the fullness of time, help smaller-scale coffee growers improve their yields and profitability, maintain their livelihoods and their environment, and prevent conversion of coffee landscapes to extensive short-term cash-crop production.

Other beneficiaries will be the researchers, students and extension personnel who will expand their opportunities, understanding and capacities for the use of ecological principles

to agricultural ecosystems. Through those beneficiaries, scientific benefits will flow through scholarly presentations to extension talks and publications for growers.

From the view point of benefits, it may be said that insect pollination is a fundamental environmental service that sustains a large component of natural and human-dependent food webs. The multi-year project to be developed will be mainly applied biology, but its goals comprise agricultural sustainability, biodiversity conservation, and a more ethical, lower synthetic chemical input, approach to crop production.