Work plan of the Cooperative Project Between KOPIA Country-Center and Counterpart institute

Project Title	Production of avocado plants (*Persea americana*) for the promotion of this fruit crop in Ecuador through practical work with avocado farmers to generate high quality drafted plants.		
Korean Implementing agency	*KOPIA Ecuador Center*	Collaborator	*Dr. Rona Bae*
Counterpart Implementing agency	Fruit Program - INIAP	Project Investigator	*Msc. William Viera*
Project Period	*2015 - 2018 (37 months)*		
Budget	*2015*	18000 USD	
	2016	12000 USD	
	2017	30000 USD	
	2018	30000 USD	
	Total amount	90000 USD	

Goal

To produce high quality avocado drafted plants for the promotion of this fruit crop in Ecuador through practical work with avocado farmers to interchange experiences and improve their productive process.

Summary

Avocado production is an economic alternative for small and medium producers, because there is a growing demand for this fruit; however, nurseries which offer plants do not reach quality standards for drafted plant production. The success of a fruit production begins with the establishment of orchards using high quality drafted plants, to ensure a proper management, high yields and incomes for farmers. This project has as objective to produce avocado high quality plants (varieties Hass and Fuerte) to contribute to the demand for avocado growers in the area of influence of the INIAP's Tumbaco Experimental Farm in the valleys; to promote the development of avocado fruit growing; and transferring the technology generated to MAGAP trainers and avocado farmers allowing to have the presence of extension technicians permanently in the territory, which provide the necessary support to small and medium producers in the area. This project will be carried out in the greenhouses from Granja Tumbaco – INIAP, through specialized staffs from the Fruit Program involve in the drafted plant propagation. The processes will have the next phases: setting seedbeds, rootstock management, drafting, and agronomical management of drafted plants. The final result will be to produce 40000 high quality drafted avocado plants to promote the cultivation of this fruit crop as well as trained farmers in the grafting process to be able to generate their own plants following standards for the plant propagation.

Expected Output

Economic effects
Farmers will improve their income by obtaining better fruit yield results of using high quality avocado plants to set their orchards. This benefit will be appreciated at medium term (after 3 years of setting the avocado plantations).

Technical effects
Continuous improvement of management technologies in production of high quality drafted avocado plants will produce the success of new orchards, based on technologies generated and transferred by INIAP. Consequently, technicians of MAGAP and farmers there will be trained nurserymen to produce the own plants.

Social and environmental effects
The promotion of fruit growing is an alternative which will improve the income of producers, even in small areas, generating a source of work. The avocado is a fruit species well adapted to the conditions of the subtropical valleys where sanitary problems are reduced, which will reduce the use of pesticides. Furthermore, avocado trees will absorb large quantities of CO2, contributing to reduce global warming. Currently, avocado is considered as a forestall species, thus, government gives benefits to farmers who want to cultivate this fruit.

1. Title

Production of avocado plants (*Persea americana*) for the promotion of this fruit crop in Ecuador through practical work with avocado farmers to generate high quality drafted plants.

2. Background

Fruit production is an economic alternative for small and medium producers, because there is a growing demand for plants to extent fruit plantations, unfortunately, much of the nurseries which offer plants do not meet quality standards.

The success of a fruit production begins with the establishment of orchards using quality plants, to ensure a proper management, high yields and incomes for farmers.

In the Tumbaco Experimental Farm of INIAP, thus fruit tree has a demand of about 20,000 plants per year, because the subtropical valleys are an important area of production for their climate and soil conditions that allow offering avocado fruit most of the time in the year and generate steady incomes for producers.

Through high quality plants of avocado, INIAP is giving technology to get high-yielding production. The principal varieties demanded by the farmers are “Hass” and “Fuerte”, both grafted onto rootstocks with resistance/tolerance to biotic and abiotic problems, contributing to the development of fruit growing in their areas of influence.
Due to the growing demand for fruit crops by farmers in the highlands and valleys, nurseries have proliferated to offer plants that do not meet minimum quality parameters, especially in sanitary aspects, which results in plants showing reduced growth, low productivity and less longevity, which

increase the cost of the agronomic management, causing economic losses for the farmer.

There is not a rigorous control to plant nurseries, contributing to the formation of nurseries with lack of qualified personnel and minimum infrastructure that ensures production of quality plants.

INIAP has a demand for fruit plants which increase year by year, thus it is a responsibility to contribute to the production of quality plants and contribute to the development and profitability of fruit production for the benefit of producers and consumers.

Based on the experience in plant production of INIAP, and the technological development of Korea, the project seeks continuous improvement of technologies for the production of avocado quality plants to attend the demand of the fruit growers.

3. Objectives

- Promote the technology for high quality avocado plant's production to be adopted for nurserymen and avocado farmers.

- To transfer the technology to produce high quality avocado plants to MAGAP trainers.

- To produce 40000 avocado high quality drafted plants (Hass and Fuerte) to contribute to the demand for avocado growers in the area of influence of the INIAP's Tumbaco Experimental Farm in the valleys.

4. Project team and responsibilities

4.1. RDA/KOPIA Center

Researcher, Institution	Responsibilities
Ph.D. Rona Bae KOPIA Ecuador-Center	Project Management

4.2. *Counterpart country*

Researcher, Institution	Responsibilities
Msc. William Viera, INIAP	*Project researcher, in charge of overall management of the project, coordinate research activities, elaborate protocols and monitoring of the research processes*
Eng. Pablo Viteri, INIAP	*Project researcher, in charge of the propagation of rootstocks and agricultural management in*

	greenhouses.
Eng. Andrea Sotomayor, INIAP	*Project researcher, in charge of plant propagation and agronomic management of the seedlings.*
Mr. Manuel Posso	*Operative process of grafting and monitoring of the plants in the greenhouse.*

5. Project Framework

5.1. Annual plan, activity and process

Each year, the following plan will be practiced because the production cycle to generate a grafted avocado is fulfilled within the twelve months of the year.

Years	Activity	Product	Responsible
2015	Adquisición de semillas e insumos	27500 seeds 200 00 twigs and su pplies	W. Viera A. Sotomayor
2016	Elaboration of the avocado plant propagation protocol	Protocol for avocado propagation	W. Viera, P. Viteri, A. Sotomayor
2016 2017	Technical Visit of INIAP's technicians to Korea	Technical report of the visit	W. Viera
2016 2017 2018	Seed selection from mother plants selected due to their good characters to know traits of the Mexican race and distinguish from other avocado races	10000 avocado rootstocks (2016) 15000 avocado rootstocks (2017) 15000 avocado rootstocks (2018)	P. Viteri, M. Posso
	Establishment of seedbeds to show the substrate preparation for planting and to show how to prepare seed before sowing		M. Posso
	Agronomical management (irrigation, fertilization, sanitary control) for development of seedlings		A. Sotomayor, M. Posso
	Selection of adequate rootstocks for grafting to know the parameters by using them for grafting		W. Viera, P. Viteri
	Selection of twigs showing sanitary traits from commercial cultivars (Fuerte and Hass) to show the adequate traits to get a good scion	10000 avocado grafted plants (2016) 15000 avocado grafted plants (2017)	W. Viera, P. Viteri
	Grafting process to demonstrate step to step the technique		W. Viera, P. Viteri
	Agronomical management for development of the grafted plants such		A. Sotomayor, M. Posso

	irrigation, fertilization, sanitary control, pruning.	15000 avocado grafted plants (2018)	
	Selection of grafted plants according to high quality standards to show the parameters for a good plant for transplanting		W. Viera, P. Viteri
	Adaptation of the grafted plants		A. Sotomayor, M. Posso
2016	Implementation of a demonstrative plot to show the development of the avocado grafted plants	One demonstrative plot	P. Viteri, M. Posso
2016 2017 2018	Technical visits of INIAP staff to nurseries and settled avocado orchards to interchange experiences and solving problems with avocado farmers	Two technical visit per year	P.Viteri, A. Sotomayor
	Avocado information uploaded in INIAP web page to know the benefits of this fruit crop and farmer will be able to access to the technology any time	One update information in the web page per year	W. Viera, A. Sotomayor
	Field day in Tumbaco Experimental Farm to show the avocado grafting process and nursery management	One field day per year	W. Viera, P.Viteri, A. Sotomayor
2018	Elaboration of Avocado Drafted Plants Bulletin to obtain a document which can be consulted by the farmer	Divulgative Bolletin	W. Viera, P. Viteri, A. Sotomayor

5.2. Materials & Methods

Management of Mexican race rootstocks tolerant to root problems

Materials: avocado seeds, substrate (dark soil + gravel), plastic bags, fertilizers, fungicides, insecticides, soil sterilizer, greenhouse.
Methods: seed selection according to the standards of the Mexican race for avocado rootsocks, establishment of seedbeds, agronomical management (nutrition and pest management) for development of seedlings, and selection of adequate rootstocks (sanitary quality, vigor) for grafting.
Using the avocado collection from the Tumbaco Farm, the avocado farmers will know the characteristics of the Mexican avocado race and the differences with other (Guatemalan and Antillean) to be able to recognize good seed for using to generate rootstocks.

Grafting and production of avocado plants

Materials: rootstocks, avocado twigs (varieties Hass and Fuerte), pruning scissor, grafting tape, plastic bags, fertilizers, fungicides, insecticides, greenhouse.
Methods: selection of twigs showing sanitary traits from commercial cultivars (Fuerte and Hass), grafting process by terminal spike method, agronomical management (nutrition and pest management) for development of the grafted plants, selection of grafted plants according to high quality standards (sanitary, vigor), and adaptation of the grafted plants.
The grafting process will be shown to the avocado farmers through visits to the avocado orchards in the Tumbaco Farm to know the characteristics for getting the scion, and the specialized staff from INIAP will demonstrate the grafting process using the Mexican rootstocks. In the Tumbaco's greenhouses, farmers will have the opportunity to make themselves the avocado grafting processes,

always supervised by INIAP technicians. Plant for demonstration will be generated by the project.

Promotion of avocado plants to farmers from the subtropical valleys.
Materials: avocado grafted plants, fertilizers, fungicides, insecticides, panels, posters, laptop.
Methods: implementation of 2 demonstrative plots with farmers who are members of the Association "Corpoaguacate" in Imbabura where producers can see the development of the grafting plants and their agronomical management. Technical visits of INIAP technicians to nurseries and settled avocado orchards were made for solving problems jointly with farmers, it will be carry out in orchards of 10 farmers from Imbabura and 10 from Pichincha. Since the second year, INIAP technicians can follow the development of the avocado grafting plants produced in the first year. Updating of avocado information INIAP's web page, thus, the avocado farmer will have access to the technologies any time.

Diffusion of the technology
Materials: rootstocks, avocado twigs (varieties Hass and Fuerte), pruning scissor, grafting tape, avocado grafted plants, fertilizers, fungicides, insecticides, panels, posters, didactical material.
Methods: field days in Tumbaco Experimental Farm of INIAP to show the whole avocado grafting process jointly with 50 farmers from Imbabura and 50 farmers from Pichincha, to diffuse the technology generated. To carry out practical grafting work with 100 farmers and nurserymen through visits to the Experimental Farm of Tumbaco.
To elaborate a bulletin about avocado plant propagation using the grafting method to obtain high quality plants, thus, the farmers will have a document to use permanently in their own activities.

Economical analysis
An economical analysis will be done to compare the cost of production between INIAP's technology and the conventional farmer technology. In addition, we calculate the investment to cultivate one hectare of avocado to know the incomes for the farmer.

6. Expected Outputs/Beneficiaries

- Organizational aspect
This project will allow to strong the relationship among INIAP, MAGAP and farmers organizations, to share the knowledge generated. At least 100 farmers will be trained in avocado plant production methods.

- Technical aspect
The nurserymen will obtain rates of more than 80% of success in grafting avocado plants.
In the long term, avocado farmer will increase their production in 20% due to the use of high quality grafted avocado plants.

- Social, economic aspect.
This project will allow increasing the avocado cultivated area in a 4%.
The grafted skills gained for the farmers, will allow using them as a working tool to generate a new source of job to get incomes.

7. Budget Plan

Activity/Items	***Dic 2015***	***2016***	***2017***	***2018***	**Total**
1. Seed for rootstocks	5500	0	4000	4000	13500

2. Establishment of seedbeds	980	0	1500	1500	3980
3. Agronomical management of seedlings	3900	1500	4000	4500	13900
4. Selection of twigs (Fuerte and Hass	4000	0	5000	4000	13000
5. Grafting process	505	0	2000	2000	4505
6. Adaptation of grafted plants	2390	1000	3000	4500	10890
7.Field day to show and transfer the technology	0	3500	3500	3500	10500
8. Technical visit of INIAP technicians to Korea	0	6000	6000	0	12000
9. Writing reports	725	0	1000	1000	2725
10. Publication of the bulletin	0	0	0	5000	5000
Total amount	18000	12000	**30000**	**30000**	**90000**

8. Project Timeline

Activity	**Year 2015**				**Year 2016**				**Year 2017**				**Year 2018**			
	Q1	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**
1. Seed Selection for rootstocks				X	X			X	X			X	X			
2. Establishment of seedbeds					X			X	X			X	X			
3. Agronomical management of seedlings					X	X		X	X	X		X	X	X		
4. Selection of adequate rootstock						X			X				X			

5. Selection of twigs (Fuerte and Hass							X			X				X		
6. Grafting process							X	X		X	X			X	X	
7. Adaptation of grafted plants								X	X		X	X			X	X
8. Selection of high quality drafted avocado plants								X	X		X	X			X	X
9. Technical visit of INIAP technicians to Korea						X				X						
10. Technical visits to avocado orchads						X		X		X		X		X		X
11. Field day in Tumbaco Experimental Farm								X				X				X
12. Written report of activities						X		X		X		X		X		X
13. Publication																X
14. Final report																X