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RESEARCH PROPOSAL (Extension for possible funding)

I. BASIC INFORMATION

Program/Project/Study Title: INTEGRATED NUTRIENT MANAGEMENT FOR HORTICULTURAL CROPS: Effects of Bio-fertilizers on soil properties and productivity of Arugula (*Eruca vesicaria*) and other herbs (*ORP10 - CAHO NM 14-1420-11*)

Program/Project/Study Leader(s): Romel B. Armecin, Dhenber C. Lusanta

Implementing Unit: Ecological Farm and Resource Management Institute (Eco-FARMI), Visayas State University

Cooperating/ Collaborating Agency (ies): none

Location: Eco-FARMI Demonstration Farm

Duration: January 2022 to December 2024

Proposed Budget: Php510,000 @ Php170,000 per year

Discipline: Soil Science, Horticulture

Classification: Basic

II. TECHNICAL INFORMATION

A. Rationale

Intensive cultivation had resulted in yield declines and in some cases susceptibility to diseases threatened the productivity of the major horticultural crop production areas. In most of the horticultural crop production systems, intensive cultivation would often led to nutrient imbalance and to some extent nutrient depletion. This is a very alarming scenario to most of the vegetable growing area which needs to be properly addressed to be able to reduce if not arrest soil degradation. The project is conceptualized to help reduce soil degradation in a horticultural crop production system.

Furthermore, a promising strategy to combat nutrient depletion using bio-organic fertilizer (BOF) products (Vermicompost, EM and IMO6) will be introduced. BOF products will be tested for pot trial experiments having different ratios of 1:2:1, 1:3:1, 0.5:4:2 and 1:4:2 (rice hull:garden soil:organic fertilizer).Soil and plant samples will be collected during harvesting and termination for the analysis to be done. The most promising material based on the analytical data will be considered as an effective bio-fertilizer for field grown crops and will be used for the field trial experiment.

B. Objectives

Develop a nutrient management strategy that could help reduce or arrest soil degradation in horticultural crop production area of VSU.

Specifically this project aims to:

1. Evaluate the effectiveness of BOF application on the growth and yield performance of the different horticultural crops (e.g. arugula) grown at the EcoFARMi demonstration farm.
2. Assess nutrient and microbial activity in the soil of the field trial experiment.

C. Logic Framework (See attached sheet)

D. Review of Literature

Soil degradation and nutrient depletion have gradually increased and have become serious threats to agricultural productivity in most developing countries. During cultivation, plants are known to synthesize nutrients in the soil and as reserve nutrients get depleted, crop growth and productivity could be compromised. Over time, cumulative depletion could impact on agricultural production, decreasing crop yields, and lowering soil fertility, leading to soil degradation. Depletion of organic matter is approximately 4% of the stock lost every year resulting in dangerously low organic carbon levels after 15-20 years of cultivation (Vanlauwe et al., 2002). In most of the

horticultural crop production systems, intensive cultivation would often led to nutrient imbalance and to some extent nutrient depletion. This is a very alarming scenario to most of the vegetable growing areas which needs to be properly addressed to be able to reduce if not arrest soil degradation.

Nutrient depletion is predicted by the experts to cause serious problems specifically in areas where farmers consistently extract more nutrients from the soil than they put in (i.e. soil mining). Scherr and Yadav (1997) reported that degradation is irreversible and most can be prevented or reversed that creates a number of "bright spots" in the developing world. It can be prevented if soil inventory of the nutrient stock are monitored regularly or through an appropriate soil health assessment. Likewise, the use of beneficial organisms such as PGPR or mycorrhiza are the approaches to help rehabilitate the nutrient deficient and disease infested areas thereby reversing soil degradation.

These are some of the nutrient management strategies that could possibly help fight soil degradation in intensively cultivated areas of the country. Through this approach, soil fertility status of the vegetable growing areas could be assessed and considered as an important indicator for soil health. With the use of beneficial microorganisms e.g. mycorrhiza, more soil volume could be explored for nutrient uptake and enhance the efficiency of nutrient absorption. Likewise, this particular technology can be showcased in an edible landscape ecosystem in a more sustainable horticultural crop production system.

E. Expected Output

Improved the growth performance of herbs (e.g. arugula), assessed the nutrient availability and microbial activity of the soil applied with BOF

F. Potential Impact:

Increase farmer's income, improved growth of herb crops (e.g. arugula), and encourage farmers to use BOF.

G. Methodology/ Workplan

Preparation, Collection and Analysis of Bio-Organic Fertilizer

Preparation and purchasing of bio-fertilizers will be done. EM will be prepared in this manner:

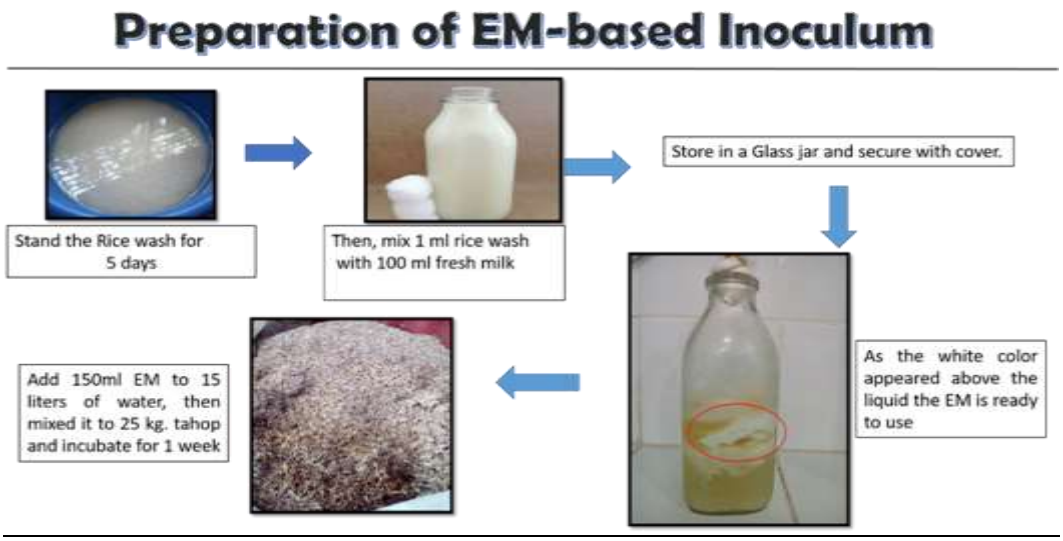

Figure 1. Preparation of EM based inoculum

Preparation and purchasing of bio- organic fertilizers will be done. EM will be prepared following the same procedure mentioned earlier. The IMO6 will be collected at Eco-FARMI Visayas State University, Visca, Baybay City, Leyte. The bio-organic fertilizers will be brought to the laboratory for the analysis of the following parameters: pH will be determined using glass electrode meter in a suspension containing a 1:5 organic fertilizer to water ratio (w/v). Organic carbon (OC) will be quantified following the Walkley-Black method while Total Nitrogen will

be done through wet digestion or Micro-Kjeldhal distillation technique. Extractable P will be done using Bray 2 extraction technique following Murphy and Riley (1962) and quantified colorimetrically using UV-vis spectrophotometer.

Field Trial Experiment

Promising treatments in the pot trial experiments (see previous study) will be used in this study. Availability of the substrates and market potential of the BOF will also be considered in selecting and choosing the material. Hence, in the field trial experiment, IMO6 and EM will be used in the study.

Soil Sample Collection and Analysis

Soil sample will be collected randomly from the experimental area. These will be composited, air-dried, pulverized, sieved (2 mm and 0.425 mm wire mesh) and will be taken in the laboratory for the initial analysis. Soil pH will be determined following the potentiometric method at 1:2.5 soil to water ratio; soil organic matter will be obtained following the Modified Walkley-Black method, Total N will be determined following the micro-kjeldahl method, and Available P will be analyzed using Bray P_2 method.

Seedling Preparation, Field preparation and Planting

Seeds will be sown in a nursery on a well-prepared seed bed. When seedlings reaches 6 weeks after sowing, they will be transplanted in the experimental field. They will be carefully uprooted and immediately planted in each designated plots.

The field trial experiment will be conducted at the Eco-FARMI demo farm. The area will be manually plowed and square boxes with dimension of 1 m x 1 m will be constructed. Arugula will be used as test crop and rice straw will be used

and served as mulch. The different bio-organic fertilizers will be applied before planting. These materials will be distributed within each treatment plot. Likewise, application of inorganic fertilizers will be done at planting at the rate of 120-60-120 kg N, P_2O_5, K_2O ha^{-1}.

Prepared seedlings will be uprooted from the nursery seedbeds and transplanted in the main field with a spacing of 20 × 20 cm. This will be done right after the application of organic fertilizers in each designated plots.

Experimental Design

The experiment will be laid out in a split-plot randomized complete block design (RCBD). There will be 9 treatment combinations replicated 3 times with 50 plant samples in each treatment. The different treatment combinations will be designated as follows:

Main Plot (Bio-fertilizers)
- B_0 – Control
- B_1 – EM
- B_2 – IMO6

Subplot (% RR of Inorganic Fertilizer)
- I_0 – 0% RR
- I_1 – 50% RR
- I_2 – 100% RR

Data to be Gathered and Maintenance of the Experimental Area

Growth performances of experimental plants will be evaluated with the following parameters:

a) Plant height (cm) – This will be measured from the ground level up to the tip of the longest leaf from ten randomly selected plants at maturity using a ruler.

b) Number of functional leaves – This will be obtained by counting the number of functional leaves produced per plant.

c) Length and width of leaf (cm) - Length will be determined by measuring the 3rd fully expanded leaf from the base of the petiole to the leaf apex. On the other hand, leaf width will be determined by measuring the widest portion of the same leaf.

d) Total biomass (g/plant) - This will be obtained by oven drying the arugula in an oven set at 70°C for 72hr. After oven drying, the samples will be weighed to determine the total biomass.

Data Analysis

The analysis of variance (ANOVA) will be computed using Statistical Tool for Statistic ver. 10. If found significant, the treatment means will be compared using Least Significant Difference (LSD) test at 5% level of significance.

References:

Scherr, S.J. and Yadav, S. (1996) Land degradation in the developing world: implications for food, agriculture, and the environment to 2020. Food, Agriculture and Environment Discussion Paper 14. International Food Policy Research Institute, Washington, DC.

Vanlauwe, B., Nziguheba, G., Nwoke, O.C., Diels, J., Saginga, N., and Merckx, R. 2002. Long term integrated soil fertility management in south-western Nigeria: crop performance and impact on the soil fertility status. Book: Lessons learned from long-term soil fertility management experiments in Africa. 175-200.

H. Milestone

Objectives	Expected Output	Activities	Months						
			1st	2nd	3rd	4th	5th	6th	7th

I. Users/Target Beneficiaries:

Organic Agriculture Production practitioners, Vegetables growers, Organic Fertilizer producers, Farmer's association

J. Budget Requirement (Philippine Peso) Use separate template provided

Operational Definition of Terms:

Title – The identification of the program/ project and the projects/ component/ studies (as defined by DOST)

Program – consists of interrelated or complimenting R&D Projects on a multi-disciplinary approach to meet established goals within a specific time frame (as defined by DOST)

Project - a set of interrelated studies to meet pre-determined objectives within a specific time frame (as defined by DOST)

Study -

Leader – the one in-charge to take the lead in program/ project/ study implementation (as defined by DOST)

Researcher – refers to person working in those capacities, who uses or creates scientific knowledge and engineering and technological principles (as defined by DOST)

Cooperating/ Collaborating Agency(ies) – agencies participating in the R&D work

Duration – number of months the program/project/study will be implemented. To include date of implementation and completion

Classification – indicates whether the program/ project is a Research (basic, applied), Development or Extension program/ project/ study (as defined by DOST)

Basic Research – an experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular or specific application or use in view(as defined by DOST)

Applied Research – is an original investigation undertaken in order to acquire new knowledge directed primarily towards a specific aim or objective (as defined by DOST)

Development – is a systematic work, drawing on existing knowledge gained from research and/or practical experience that is directed to producing new materials, products or devices, installing new processes, systems and services and improving substantially those already produced or installed

Discipline – the specific field to be studied

Users/ Target Beneficiaries – refers to the clientele

Personal Services (PS) – total requirement for wages, salaries, honoraria, additional hire and other personnel benefits (as defined by DOST)

Maintenance and Other Operating Expenses (MOOE) – total requirement for supplies, materials, travel expenses, communication and other services (as defined by DA-BAR)

LOGICAL FRAMEWORK

Project Title: INTEGRATED NUTRIENT MANAGEMENT FOR HORTICULTURAL CROPS: Effects of Bio-fertilizers on soil properties and productivity of Arugula (*Eruca vesicaria*) and other herbs

Narrative Summary	Project Targets – Objectively Verifiable Indicators	Means of Verification	Assumptions
Goal: To be able to develop a nutrient management strategy that could help reduce or arrest soil degradation in horticultural crop production area of VSU	(a) Developed an appropriate nutrient management strategies for horticultural crops under VSU condition; (b) Increased income of the farmers practicing organic agriculture production	Living status and indices, Annual reports of line agencies	Market prices will remain favourable and stable; Farmers are willing to adopt the organic farming technologies
Purpose: (a) Evaluate the effectiveness of BOF application on the growth and yield performance of the different horticultural crops (e.g. arugula) grown at the EcoFARMi demonstration farm. (b) Assess nutrient and microbial activity in the soil of the field trial experiment (c) Determine the nutrient uptake of arugula in the field trial experiment	Improved the production of herbs with the use of BOF Analysed the soil and tissue samples of the field trial set-up	Laboratory analysis result, photodoc, and progress reports	Continuing support of the government in the promotion of the organic agriculture program for sustainable crop production in the countryside.

Narrative Summary	Project Targets – Objectively Verifiable Indicators	Means of Verification	Assumptions
Project Outputs: 1. Prepared and produced organic fertilizers for the project producers 2. Analyzed the collected samples 3. Evaluated the organic fertilizer for herbs production 4. Published article in peer-reviewed journal	(a) 100% of the samples were analysed (c) Increased farm productivity by 10% through the use effective organic fertilizer (d) One article published in peer-reviewed journal	Photodocs, Progress reports, published articles	Stakeholders are willing to adopt the technology on organic herb production
Activities: 1. Collection and preparation of substrates for fertilizer production 2. Production and analysis of organic fertilizer produced 3. Field Evaluation on the effectiveness of organic fertilizer using herbs as test crops 4. Report writing	Inputs (Php): Supplies – 50,000 Preparation and establishment of experimental area – 50,000 Maintenance of experimental area – 50,000	Vouchers, acknowledgement receipts, laboratory analysis results, data of the field trial experiments, photodoc, and progress reports	a) On-time release of allocations in line with the proposed activities and work plans; b) Gov't remains committed to the various stakeholders involved for the promotion of the organic agriculture program; c) Farmers are willing to adopt the organic agriculture production technologies