DOST Form 2 (for Basic/Applied Research)

DETAILED RESEARCH & DEVELOPMENT PROJECT PROPOSAL

(1) PROJECT PROFILE

Program Title: Local Grants-in-Aid

Project Title: Improving Garlic Production Using Technology-based Innovations in Occidental Mindoro

Project Leader/Sex: Mary Yole Apple Declaro-Ruedas / Female/Occidental Mindoro State College

: Emmanuel G. Ruedas/Male/Magsaysay First Christian School Multipurpose Cooperative

Project Duration (number of months): 12 months for project implementation / 24 months for monitoring of outcomes

Project Start Date: January 2024

Project End Date: January 2027

Implementing Agency (Name of University-College-Institute, Department/Organization or Company):

Occidental Mindoro State College (OMSC)

Address/Telephone/Fax/Email (Barangay, Municipality, District, Province, Region):

Barangay Labangan, San Jose, Occidental Mindoro/myad.ruedas@omsc.ph.education

(2) COOPERATING AGENCY/IES (Name/s and Address/es)

Occidental Mindoro State College / Barangay Labangan, San Jose, Occidental Mindoro

(3) SITE(S) OF IMPLEMENTATION

IMPLEMENTATION SITES NO.	COUNTRY	REGION	PROVINCE	DISTRICT	MUNICIPALITY	BARANGAY
1.	Philippines	MIMAROPA	Occidental Mindoro	Lone	Magsaysay	Poblacion
2.	Philippines	MIMAROPA	Occidental Mindoro	Lone	Lubang/Rizal	Aguas

(4) TYPE OF RESEARCH

_____. Basic

__✓__. Applied

(5) R&D PRIORITY AREA & PROGRAM (based on HNRDA 2017-2022)

__✓__ Agriculture, Aquatic and Natural Resources
Commodity: Garlic

_____Health
Priority Topic: _____

_____Industry, Energy and Emerging Technology
Sector:

_____Disaster Risk Reduction and Climate Change Adaptation

_____Basic Research
Sector: _____

Sustainable Development Goal (SDG) Addressed

SDG No. 2- Zero Hunger

By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality.

(6) EXECUTIVE SUMMARY (not to exceed 200 words)

Garlic is the most important Allium crop and oldest known horticultural crops, ranks second next to onion in the world. It is mainly used for flavoring and seasoning vegetables in different dishes and also has many medicinal properties. Poor agronomic practices are among the major constraints limiting the production and productivity of this crop. Improving agronomic practices such as seedbed preparation, sowing date, planting methods seed rate, weed control and pest management will enhance the production and productivity of garlic. A number of studies in various parts of the world had been conducted to improve its production. There are numerous problem in garlic production that accounted to low yield or reduction of yield. Some of these are level of fertilizer application, weed management practice, irrigation and mulching. The objective of this project is to improve garlic production through the recommended technologies such as the application of Gibberellic Acid (GA3) and other foliar fertilizers develop by OMSC (seaweeds, kohol amini acids, liquid trichoderma, rabbit vermitea), and the use of improved varieties.

(7) INTRODUCTION

Garlic (Allium sativum) is a shallow-rooted plant with bulb forming close to the surface. The bulblets are known as cloves. Garlic is frequently use as food seasoning. It has attracted particular attention because of its widespread use around the world and the cherished beliefs many have had that it has kept them healthy, health them toward of illnesses and given them more vigor (Milner, 2010).

According to Acdal (2006), there are only ten regions in the Philippines which produced garlic. These are follows: Ilocos Region, MIMAROPA, CALABARZON, and Central Luzon, Bicol regions Cagayan Valley, Western Visayas, Central Visayas, CAR, and Eastern Visayas. The Occidental Mindoro province ranked second as the garlic producing in the Philippines with 17% share to the national production (BAS, 2013) but with a decreasing area planted, dwelling from 3,800 hectares in 2008; 3,600 in 2009; and 3,000 last year (Declaro-Ruedas, et al., 2013).

Garlic yields are decreasing due to a number of constraints, among which lack of balanced nutrient supply, poor soil fertility, weed infestation, diseases, and moisture stress are the major ones (Shiferaw, 2014). There are numerous problem in garlic production that accounted to low yield or reduction of yield. Some of these are level of fertilizer application, weed management practice, irrigation and mulching.
In Mindoro, Philippines, garlic cultivars planted include 'Mindoro White' (MW), 'Lubang' (LB), 'Batanes White' (BW), and 'Ilocos White' (IW) (Ragas et al, 2019). According to Stavelikova (2008), garlic (Allium sativum L.) is a monocotyledonous herb that produces a bulb, an aggregate of sheath-covered cloves serving as the main economic organ. Garlic is dry season crop because it is harvested during the hot summer months (Agribusiness, 2011).

The poor yield of garlic may be due to the lack of inadequate soil and water management practices with reference to soil water shortage in the soil profile. Successful garlic cultivation largely depends on the optimum cultural management practices. These include judicious manuring, efficient use of residual soil moisture, land preparation and mulching (Kabir et al, 2016). Further, the poor yield of garlic may be due to inadequate soil and water management practices in particular to soil water shortage in the soil profile. However, a considerable amount of fallow land can be brought under garlic cultivation through utilization (Alam et al, 2017).

(7.3) OBJECTIVES

Phase 1- Garlic Production Documentation and Value Chain Analysis of Garlic in Occidental Mindoro

The study will be undertaken to determine the garlic production, marketing system, marketing cost, marketing margin, and marketing efficiencies and to examine the value chain of garlic, aiming to determine the value addition in different steps of garlic marketing.

Phase 2-Utilization of technologies for Garlic Production

The objective of this project is to improve garlic production through the recommended technologies such as the application of Gibberellic Acid (GA3) and other foliar fertilizers develop by OMSC (seaweeds, kohol amini acids, liquid trichoderma, rabbit vermitea), and the use of improved varieties. Specifically, it aims to:

1. Determine the growth and yield response of garlic applied with different type of mulch;
2. Determine the significant difference on the growth and yield performance of garlic as affected by different foliar fertilizer;
3. Identify the best foliar fertilizer to be used in garlic production in the Occidental Mindoro condition; and
4. Evaluate the economic analysis of the garlic production using the different foliar fertilizers.

(8) REVIEW OF LITERATURE

Among the several factors affecting the productivity of the crop, nutrition plays an important role. Bulb crops are a heavy feeder, requiring optimum supplies of nitrogen, phosphorus, potassium and sulphur and other nutrients, which can adversely affect the growth, yield and quality of bulbs under sub-optimal levels in the soil (Gubb and Tavis 2002). However, the balance dose of macronutrients with other cultural practices is indispensible to fetch maximum productivity, role of micronutrients in increasing the quality and overcoming the physiological disorder is equally important (Selvaraj et al. 2002).

Fertilization can be categorized into two primary processes, namely root fertilization and foliar fertilization. Foliar fertilization is capable of direct absorption through the leaves, enabling faster and more effective transportation to other plant organs in comparison to root fertilization [5,6]. In addition, foliar fertilization can be applied through spraying at specific times and dosages, according to the specific needs of various plants during their distinct growth stages. This particular form of fertilization may be deemed more appropriate in meeting the specific requirements of the plant, as opposed to fertilization through the roots.

Organic fertilizers of various kinds are used as a complement to mineral fertilizers, because they are a practice that reduces the excessive use of mineral fertilizers costly for production (Victor et al., 2013). The addition of organic fertilizers is essential for plant growth and for increasing agricultural production, but high, unexamined and frequent additives have poor consequences and can cause many problems for soil and the environment (Hassanein and Kandil, 2004).

A study conducted by Swetha and Hiremath (2017) investigated the impact of foliar fertilization on the growth, yield, and yield characteristics of garlic. The experiment took place at Saidapur Farm, University of Agricultural Sciences, Dharwad, during the Rabi season of 2015-16. The plants were cultivated using the prescribed

amount of fertilizer, supplemented with a foliar spray of a one percent solution of 19:19:19 at 60 days following sowing (T11). The experimental results demonstrated notable increases in various plant characteristics, including plant height (51.99 cm), number of leaves per plant (6.00), leaf length (41.05 cm), leaf breadth (1. 03 cm), neck diameter (4.76 mm), bulb weight (15.60 g), bulb diameter (33.23 mm), number of cloves per bulb (25.93), clove length (1.98 cm), hundred clove weight (108.49 g), yield (6.98 t/ha), and B:C ratio (2.84). The absence of foliar spray treatment, namely the administration of only the recommended dose of fertilizer, resulted in poor growth, yield, and yield characteristics.

(9) METHODOLOGY

Phase 1

The research will be descriptive research. The respondents will be from the garlic-growing municipalities in Occidental Mindoro.

Phase 2

Materials and Methods

Materials

The materials used were the following:

Quantity	Unit	Particulars
3600	Pieces	Garlic cloves
12	Pieces	Tags/Label
1	Piece	Weighing scale
1	Piece	Sprayer
1	Piece	Meter stick
1	Piece	Vernier caliper
1	Piece	Notebook
50	Packs	Gibberellic Acid (GA3)

Methods

Time and Place of the Study

This study will be conducted in Magsaysay, Lubang and or Rizal, Occidental Mindoro from January 2024 to 2027.

Research Design

This study will employ experimental methods of research in order to determine the growth and yield of garlic using different types of foliar fertilizer.

Experimental Layout

The Randomized Complete Block Design (RCBD) will be used in this study. The field will be divided into units to account for any variation in the field. Treatments were then assigned at random to the experimental units in the blocks-once in each block.

The test plant will receive the same cultural management except for the fertilization management. The following treatments were replicated three times:

T1- Chemical
T2- GAA (Gibberellic Acid)
T3- Developed Foliar fertilizer by OMSC

R1- Replicate 1
R2- Replicate 2
R3- Replicate

Block 1	Block 2	Block 3
T3R1	T2R2	T1R3
T2R1	T1R2	T3R3
T1R1	T3R2	T2R3

Fig. 2. Experimental lay-out.

No. of treatments = 3
No. of replication = 3
No. of plants = 3600 cloves
Distance planting = 20 centimetres (cm) x 20 cm
Total Area = 490.25 sq.m^2

Cultural Practices and Management

Soil and Climatic Requirements

Garlic can be grown in different types of soil. However, sandy, silt, fertile, and clay loam are recommended for commercial production. The soil should be fertile, rich in organic matter, well drained, and capable of holding adequate mixture during the growing period.

Land Preparation

This study will employ the maximum tillage of land preparation. The field will be plowed when the soil had attained the right moisture for land preparation. About a week after, when the weeds have dried up, the field is flush-irrigated and harrowed until the soil is well- pulverized.

Selection of Planting Materials

Fully matured and well-developed bulbs of medium to large cloves will be selected as planting materials. The planting material will be prepared by separating the clove from one another. The cloves from the outer parts (first layer) of the bulb are the best planting materials.

Distance of Planting

In this study, the distance of planting will be 20 centimeters (cm) x 20 cm.

Mulching

Mulch will be applied after planting. Mulch is evenly laid on the field with a thickness of 3cm. Rice straw will be used as mulching.

Irrigation

In preparing for planting, it is necessary to irrigate the field a day or two days earlier. To supply adequate water, a water pumping engine conveyed through inlet canals will be used. Irrigation will be done every 8-10 days.

Fertilization

In the absence of soil analysis, a 1-ha production area requires 7 bags of complete fertilizer (14-14-14), 2 bags of urea (46-0-0), 2 bags of superphosphate (0-18-0) and a bag of muriate of potash (0-0-60). Apply all 0-18-0 and 14-14-14 as basal fertilizer prior to planting. Apply a combination of 46-0-0 and 0-0-60 at 30, 50 and 70 after planting (Agri.Business, 2011).

It will be applied in the morning or late afternoon, since hot days cause the pores on plants leaves to close. The following fertilization will be used:

Treatment	Basal Fertilizer	Foliar Fertilizer
T1	2 kg of 16-20-0 and 46-0-0	Chemical
T2	2 kg of 16-20-0 and 46-0-0	GAA (Gibberellic Acid)
T3	2 kg of 16-20-0 and 46-0-0	OMSC Foliar Fertlizer

Pest and Diseases Management

Pest and disease management will be done based on its occurrence***.***

Weeding

Generally, garlic is grown under mulch. Weeds appearing in the mulch will be removed with the use of a narrow- bladed hand trowel. Hand weeding will be done to control weeds at the early stage of growth of garlic to prevent competition for nutrients, water and sunlight.

Harvesting

Harvesting will be done manually by pulling matured individual plants by hand. For long- term storage, the sign is when the stem and skin become hard, and the skin also becomes dry. Uproot mature plants from the ground and arrange in windrows with leaves on to protect the bulbs from the sun. When leaves have completely dried it will be braided and placed in trays for further curing and storage.

Storage

Harvested garlic will be graded after curing in the field for 3-4 days. Afterwards it will be stored in bundles, hung in rows with bamboo stick or lumber in well-ventilated area.

Statistical Tools

The analysis of variance (ANOVA) at 5% level of significance using statistical software will be used in analyzing and interpreting the data.

(10) TECHNOLOGY ROADMAP (if applicable) (use the attached sheet)

(11) EXPECTED OUTPUTS (6Ps)

Publication

Out of this project, technical papers will be prepared for paper presentation at the International Society for Southeast Asian Agricultural Sciences (ISAAS) Philippines National Conference and/or MiMaRoPa Agriculture, Aquatic and Natural Resources Research and Development Consortium (MAARRDEC). Research paper will also be written and be submitted for publications in journals.

Patent/Intellectual Property

Utility model will be applied for patent for the design and for the operation of the plant.

Product

Garlic that is organically grown using the OMSC developed products.

People Service

Farmers will benefit from it for reducing the cost of farm inputs.

Place and Partnership

OMSC will be partnering with the LGU Municipal Agriculture Office in disseminating the result of the study through extension and technical advisory services.

Policy

It would strengthen the existing policy in LGU-Magsaysay on Organic Agriculture that would require the utilization of natural raw materials as source of fertilizer.

(12) POTENTIAL OUTCOMES

This project will lead to the:

a. utilization of available raw materials used as foliar fertilizer;
b. reduction of input cost for garlic farmers; and
c. promotion of the advocacy of organic agriculture in the province.

(13) POTENTIAL IMPACTS (2Is)

Social Impact- The technology can provide farmers who are members of the cooperatives an improvement in their garlic production that could redound to additional income and access to technical services.

Economic Impact- Cost reduction in garlic production. Minimize the use of chemical fertilizers/inputs for production.

(14) TARGET BENEFICIARIES

Garlic farmers in Occidental Mindoro specifically members of the cooperatives.

(15) SUSTAINABILITY PLAN (if applicable)

(16) GENDER AND DEVELOPMENT (GAD) SCORE (refer to the attached GAD checklist)

The HDGD Checklist score is 10.83, which means that the proposed project is gender sensitive.

(17) LIMITATIONS OF THE PROJECT

The project is limited to the field experiments and the variety of garlic that will be used in the research project.

(18) LIST OF RISKS AND ASSUMPTIONS RISK MANAGEMENT PLAN (List possible risks and assumptions in attaining target outputs or objectives.) Please see DOST Form 5C Risks and Assumptions

(19) LITERATURE CITED

Agribusiness.(2011). Growing Garlic (Allium sativum L.)- Garlic Production Guide. http://pinoybisnes.com

Agribusiness.(2015). Garlic Production Guide. http://businessdiary.com.ph/2617/garlic-production-guide/#ixzz3zdAZgjJQ

Brewster, J. L. (1990): Physiology of Crop Growth and Bulbing. – In: Rabinowitch, H. D., Brewster, J. L. (eds.) Onions and Other Vegetable Alliums. CRC Press, Boca Raton, FL, pp. 53-88.

Brewster, J. L. (2008): Onions and Other Vegetable Alliums, 2nd ed. – CABI Publishing, Wallingford, Oxfordshire, UK.

DAR.(2010). Department of Agrarian Reform San Jose Occidental Mindoro. http://www.darocmin.com.ph

Gubb, IR and Tavis, MSH (2002). Onion preharvest and post-harvest considerations. In: H.D. Rabinowitch, and L. Currah(eds.). Allium Crop Science, CABI publishing, UK. pp 237-250

Hassanein, S., Nabil Fathi El-Sayed Kandil (2004). Clean Agriculture, Center for Agricultural Research and Central Agricultural Extension, Ministry of Agriculture and Land Reclamation of the Arab Republic of Egypt

Ragas, R, Padron,F & Ruedas, M**.** (2019). Analysis of the morpho-anatomical traits of four major garlic (*Allium sativum* L.) cultivars in the Philippines. Applied Ecology And Environmental Research 17(1):1143- 1157.

Selvaraj, N, Natarajan, S, Selvarajan, VM, Mathews, S and Pabitha, A (2002). Effect of foliar application of micronutrients on growth and yield of garlic (Allium satium L.). South Indian Hort 50(1-3): 159-168.

Stavelikova, H. (2008): Morphological characteristics of garlic (Allium sativum L.) genetic resources collection information. – Horticultural Science (Prague) 35(3): 130-135. https://doi.org/ 0.17221/661-HORTSCI.

Shweta, K. ; Hiremath, S. M. (2017). Effect of foliar fertilization on growth and yield attributes of garlic. Asian Journal of Horticulture 2017 Vol.12 No.2 pp.247-250

Victor, M., Teixeira, A., Reis, E., and Mendonca, E. (2013). Yield and nutritional status of the coniloncoffee tree in organic fertilizer systems. Rev. Cienc.Agron., 44(4): 773-781

(20) PERSONNEL REQUIREMENT

Position	Percent Time Devoted to the Project	Responsibilities
Consultant	25%	Technical aspects of the technology
Researcher	50%	Data gathering and analysis

(21) BUDGET BY IMPLEMENTING AGENCY

IMPLEMENTING AGENCY	PS (Labor)	MOOE	EO	Total
Year 1		525,386.33		525,386.33
TOTAL		**525,386.33**		525,386.33

(22) OTHER ONGOING PROJECTS BEING HANDLED BY THE PROJECT LEADER: _One (1)___

Title of the Project	Funding Agency	Involvement in the Project
IMPROVED FARM MANAGEMENT THROUGH SOLAR-POWERED AUTOMATIC DRIP IRRIGATION SYSTEM FOR ONION AND HIGH VALUE CROPS IN MAGSAYSAY, OCCIDENTAL MINDORO	GIA-DOST	Project Leader

(23) OTHER SUPPORTING DOCUMENTS (Please refer to page 2 for the additional necessary documents.)

I hereby certify the truth of the foregoing and have no pending financial and/or technical obligations from the DOST and its attached Agencies. I further certify that the programs/projects being handled is within the prescribed number as stipulated in the DOST-GIA Guidelines. Any willful omission/false statement shall be a basis of disapproval and cancellation of the project.

	SUBMITTED BY (Project Leader)	ENDORSED BY (Head of the Agency)
Signature		
Printed Name	**Mary-Yole Apple Declaro-Ruedas**	**Dr. Ma. Josefina P. Abilay**
Designation/Title	Director for Extension, OMSC	Regional Director, DOST-MIMAROPA
Date		

Note: See guidelines/definitions at the back

PROJECT PROCUREMENT MANAGEMENT PLAN

Procurement Unit: **RDE- Research**

Year 1

	Item & Specifications	Unit of Measure	Monthly Quantity Requirement												Total Quantity for the year	Price Catalogue	Total Amount for the year
			Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec			
Agricultural Supplies and materials from OMSC Fund																	
1	Insecticide (Goal)	Bottle													2	1500.00	3,000.00
2	Herbicide (Symakor)	Bottle													2	1250.00	2,500.00
3	Growth enhancer (Gibberellic Acid (GA3)	pack													50	700.00	35,000.00
4	Herbicide (Armor)	box													1	900.00	900.00
5	Insecticide (Symbush)	box													2	1300.00	2,600.00
6	Garlic (Lubang)	kg													50	3000.00	150,000.00
7	Urea	sack													12	1200.00	14,400.00
8	16-20	sack													12	2300.00	27,600.00
9	46-0-0	sack													12	2300.00	27,600.00
10	Plastic mulch	roll										10				5000	50,000.00
11	Hose 1"	set										3				5000	15,000.00
12	Sprayer, battery type 3 in 1	unit										2				3500	7,000.00
13	Bamboo post	piece										50				100	5,000.00
14	Spade	piece										2				250	500.00
15	Hog wire, 7 holes	roll										6				1700	10,200.00
16	OMSC Foliar	bottle													30	200	6,000.00
17	Hose, 1"	roll										1				4000	4,000.00
																Total	**361,300.00**
Labor																	
1	Land preparation	Service													4	3500	12000.00
2	Labor (planting)	service													15	350	3000.00
3	Labor (weeding/spray)	Service													50	300	15000.00
4	Harvest activities	Service													15	300	6000.00
																	36,000.00

DOST Form 4

DEPARTMENT OF SCIENCE AND TECHNOLOGY
Project Line-Item Budget
CY 2024

Program Title	: Grant In Aid (GIA)
Project Title	: Improving Garlic Production Using Technology-based Innovations in Magsaysay and Lubang, Occidental Mindoro
Implementing Agency	: DOST-MIMAROPA
Total Duration	: 1 year for project implementation/ 2 years for monitoring of outcomes
Current Duration	: 1 year
Cooperating Agency	: Occidental Mindoro State College (OMSC)
Program Leader	: DR. MA. JOSEFINA P. ABILAY
Project Leader	: MARY YOLE APPLE DE CLARO-RUEDAS
Monitoring Agency	: DOST-MIMAROPA PSTO-Occ. Mindoro

	DOST-MIMAROPA	Counterpart Funding OMSC
I. Personal Services		
Direct cost		(80,000 salary*12 months*0.15% Time)
Salaries		144,000.00
II. Maintenance and Other Operating Expenses		
Direct Cost		
Traveling Expenses		
Local	90,386.33	
Training Expenses		
Traveling Expenses	20,000.00	20,000.00
Supplies and Materials Expenses		
Other Professional Services/Labor cost	1,400.00	50,000.00
Printing and Publication Expenses		
Representation Expenses	8,600.00	
Supplies and Materials Expenses		
Office Supplies Expenses	18,000.00	
Semi-Expendable Machinery and Equipment Expenses -Laptop/Printing Equipment	15,000.00	
Semi-Expendable Furniture, Fixtures and Books Expenses	14,500.00	
Other Supplies and Materials Expenses	362,000.00	50,000.00
Communication Expenses		
Mobile Expenses	5,850.00	
Internet Subscription Expenses	9,000.00	
Rent/Lease Expenses		
Sub-Total for MOOE	**P 544,736.33**	**P 264,000.00**
GRAND TOTAL	**P 544,736.33**	**P 264,000.00**

Prepared by:

MARY YOLE APPLE DECLARO-RUEDAS
Project Leader

Approved by:

DR. MA. JOSEFINA P. ABILAY
Regional Director, DOST-MIMAROPA

Certified Funds Available:

MYRA SOMINTAC
Budget Officer

JAY RALPH A. CABIAO
Accountant III, DOST-MIMAROPA