# ENHANCING BULB YIELD AND VITAMIN C OF GARLIC (*Allium sativum* L.) THROUGH AMINO ACID BIOSTIMULANT APPLICATION

**ERWIN NITORADA BAGUISE**

A master's thesis submitted to the faculty of the Department of Crop Science, College of Agriculture, Central Luzon State University, Science City of Muñoz, Nueva Ecija, Philippines in partial fulfillment of the requirements for the degree

**MASTER OF SCIENCE**
**(Crop Science)**

**FEBRUARY 2018**

This master's thesis entitled, **ENHANCING BULB YIELD AND VITAMIN C OF GARLIC (*Allium sativum* L.) THROUGH AMINO ACID BIOSTIMULANT APPLICATION,** prepared and submitted by **ERWIN N. BAGUISE,** in partial fulfillment of the requirements for the degree, **MASTER OF SCIENCE (Crop Science - Horticulture),** is hereby accepted.

**NENITA E. DELA CRUZ**
Member, Advisory Committee

01/15/18
Date Signed

**ROSEMARIE T. TAPIC**
Member, Advisory Committee

01/10/18
Date Signed

**NEMESIO V. TAMAYO**
Chair, Advisory Committee

01/10/18
Date Signed

Accepted as partial fulfillment of the requirements for the degree, **MASTER OF SCIENCE (Crop Science – Horticulture).**

**ROSEMARIE T. TAPIC**
Chair, Department of Crop Science

01/23/18
Date Signed

**ERNESTO A. MARTIN**
Dean

01/23/18
Date Signed

## ACKNOWLEDGEMENT

Above all, the author extends his greatest gratitude, praise, worship, and thanks giving to our Heavenly Father for the strength, skills, knowledge, and perseverance, for all the blessings and guidance He gave that led his every step of the way.

The author also deeply appreciates and expresses his sincerest gratitude to the following persons and institutions that extended their unselfish guidance, encouragement, support, pieces of advice, camaraderie and help for the completion of this thesis:

The Department of Science and Technology - Accelerated Science and Technology Human Resource Development Program (DOST-ASTHRDP), for the scholarship given him to pursue graduate studies;

The Department of Science and Technology – Cordillera Administrative Region, Regional Standards and Testing Laboratory for nutrient (vitamin C) analysis of garlic samples;

Dr. Nemesio V. Tamayo, chairperson of his advisory committee, who extended his immeasurable assistance and guidance for the improvement of this work, for the trust, encouragement, recommendation and pieces of advice before and after the conduct of this study, as well as in the preparation and completion of this manuscript;

Dr. Nenita E. Dela Cruz and Dr. Rosemarie T. Tapic, the members of his advisory committee; Dr. Mario B. Agustin and Prof. Florida C. Garcia, chairman and member of the examining committee, respectively, for the constructive and insightful comments,

suggestions and criticisms which further contributed to the improvement and development of this manuscript;

Dr. Ernesto A. Martin, Dean of the College of Agriculture; Dr. Rosemarie T. Tapic, Department Chairman of Crop Science and all faculty members of Crop Science especially to Dr. Quirino D. Dela Cruz, Prof. Facifico T. Vizmonte Jr. and Dr. Justo G. Canare Jr., for endorsement in DOST, for kindness and advice;

Uncle Ariel Danzalan (deceased), owner of the experimental field, for providing his land area; Tito Constancio Digap, Tita Amelita Digap, Ate Janet Tamayo, Kuya Margarito Tamayo and Karen Grace Digap for their kindness, generosity, help and concern while the author and his family went to Barangay Bacayao while working at the field;

Uncle Jesus "JB" Digap, for kindness and accommodation, as well as for extending his time to accompany the author in buying the Ilocos white variety of garlic at Pasuquin, Ilocos Norte, and to Jay Digap Jr. for touring the author at Laoag City, Ilocos Norte;

His classmates and friends, Dionie Barrientos, Shajarah Fatima Dimasingkil, Babylyn Tabing, Lea Asuncion, Joanne Marzan, Adley Masnar, Nazario Tuguinay, Luz Asio, Nyle Pardillo, Arnold Ventura, Myla Santiago, Maribelle Astejada, Bryan Igie De Guzman and others who gave moral and spiritual support, happy memories and made his graduate studies more meaningful and worth cherishing;

Ate Erica Baguise, Kuya Jayson Tablizo, Jasper King Simon, Shiela Mae Pabrua, Meloen Pabrua, Jorien Tanca, Dan Carlo Laderas, Uncle Roger Baguise, Apo Mary

Nitorada and Ninang Gemma Medrano, for concerned, kindness and help; and also to Rheil-em Baguise, Emily Baguise and Jaira Zeyn Tablizo, his nephew, for the love;

Lexter Rosario and Wawie Reyes, his best friends, who were his companion during the preparation and writing of this study; for brotherly concern, immeasurable support, advice, motivation, inspiration, encouragement, and camaraderie who made his stay in San Carlos City a memorable one; also to their family for kindness, generosity, and concern while the author resides at Barangay Pangoloan while writing this manuscript;

This Acknowledgement will not be complete without mentioning the much needed love as well as the moral and financial support extended by his beloved parents, Mr. Rolando C. Baguise and Mrs. Susan N. Baguise, for their advice which serve as the foundations of his strong determination, for without their encouragement, love and sacrifices he would not have attained his graduate studies;

Also the author would like to thank his two brothers Rowel Baguise, Emil Baguise and his sister Roxanne Baguise Tablizo, for encouraging him to do his best and for moral and financial support.

To those whose names were not mentioned but whose encouragement and support cannot be overlooked, a heartfelt thanks and gratitude are accorded to them.

**ERWIN N. BAGUISE**

## TABLE OF CONTENTS

## LIST OF TABLES

# LIST OF APPENDIX TABLES

## LIST OF APPENDIX FIGURES

## ABSTRACT

**BAGUISE, ERWIN, N.,** Department of Crop Science, College of Agriculture, Central Luzon State University, Science City of Muñoz, Nueva Ecija. **FEBRUARY 2018. ENHANCING BULB YIELD AND VITAMIN C OF GARLIC (*Allium sativum* L.) THROUGH AMINO ACID BIOSTIMULANT APPLICATION.**

Adviser: **NEMESIO V. TAMAYO, PhD**

An experiment was conducted using different levels of amino acid biostimulant combined with inorganic fertilizers to evaluate the growth and yield response of Ilocos white garlic to amino acid bio-stimulant application, analyze the vitamin C of Ilocos white garlic applied with amino acid bio-stimulant, identify the rate of amino acid bio-stimulant that will lead to higher vitamin C and higher yield, and identify the rate of amino acid bio-stimulant in combination with inorganic fertilizer that will lead to higher vitamin C and higher yield. The study was set up following the experimental layout of single factor experiment arranged in Randomized Complete Block Design with three replications. The garlic plants were subjected to application of 1,500 ppm, 2,100 ppm, and 2,800 ppm AAB alone and with 1/2 RR of IF.

Results of the experiment showed that plants applied with 2,800 ppm AAB + ½ RR of IF produced 50.18 cm plant height, 3.02 g above ground dry matter yield, and 3.24 tons yield per hectare. This treatment also produced least number of bulbs to a kilogram (139 bulbs). On the other hand, the plants applied with 2,100 ppm AAB + ½ RR of IF obtained highest average number of cloves per bulb (22 cloves), highest equatorial

diameter (27.40 mm), and heaviest weight of bulb (12.29 g) and the treatment that attained the highest vitamin C content of Ilocos white garlic was with application of 2,800 ppm AAB alone that produced 58 mg/100ml of vitamin C.

Moreover, the diameter and average weight of bulb was increased significantly with the application of varying levels of amino acid biostimulant.

## LITERATURE CITED


AGRI BUSINESS. 2011. Growing Garlic (*Allium sativum* L). Pinoy.business.com

ALLEN, J. 2009. Garlic Production. Ministry of Agriculture, Food and Rural Affairs, Ontario. 09-011w

AMIN, A.A.; F.A.E. GHARIB; M. EL-AWADI and E. M. RASHad, (2011). Physiological response of onion plants to foliar application of putrescine and glutamine. Scientia horticulturae, 129(3):353-360.

ANJUM K., M. AHMED, J. K. BABER, M. A. ALIZIA, N. AHMED, and M. H. TAREEN. (2014). Response of Garlic Bulb Yield to Bio-stimulant Under Calcareous Soil. Life Sci. Int. J., Vol: 8, (Issue, 1, 2, 3, & 4) Jan., April, July & Oct. 2014 Page: 3058-3062

BAS, 2013. Bureau of Agricultural Statistics Report. Ilocos Times. Ilocandia's Bastion of Press Freedom.

DAR W., 2017. Developing the local garlic industry. The Manila Times. 2/F Sitio Grande Building 409 A. Soriano Avenue, Intramuros Manila 1002. http://www.manilatimes.net/developing-local-garlic-industry/349356/.

DIRIBA-SHIFERAW, G., R. NIGUSSIE-DECHASSA, W. KEBEDE, T. GETACHEW and J. SHARMA. 2013. Growth and Nutrients Content and Uptake of Garlic (*Allium sativum* L.) as Influenced by Different Types of Fertilizers and Soils. STAR Journal. 2(3): 35-50

EBIC, 2013. Economic overview of the biostimulants sector in Europe. European Biostimulants industry Council. http://www.biostimulants.eu/2013/04/2013-overview-of-the-european-biostimulants-market

EL-SHABASI, M.S., S.M. MOHAMED and S.A. MAHFOUZ, 2005. Effect of foliar spray with some amino acids on growth, yield and chemical composition of garlic plants. The 6th Arabian Conf. for Hort., Ismailia, Egypt.

EUROPEAN BIOSTIMULANTS INDUSTRY COUNCIL. 2011. Promoting the biostimulant industry and the role of plant biostimulants in making agriculture more sustainable. www.biostimulants.eu.

FAWZY, Z.F., Z.S. EL-SHAL, LI YUNSHENG, Z. OUYANG and M.S. OMAIMA. 2012. Response of Garlic (Allium sativum, L.) Plants To Foliar Spraying of Some Bio-Stimulants Under Sandy Soil Condition. Journal of Applied Sciences Research, 8(2): 770-776

GUMAPAC, M. 2011. Garlic: Expanding what we know and what we should. Vol. 12 No. 9

JAGGI, R. C. and S. K. RAINA. 2005. Nutrient Content in Garlic (*Allium sativum*) as Indices of Yield and Yield Attributes. Agropedology, 15(2),107-109

KUDI, T. M., A. L. BANTA, J. G. AKPOKO and D. WAYNET. 2008. Economic Analysis of Garlic Production in Bebeji Local Government Area of Kano State, Nigeria. Ozean Journal of Applied Sciences 1(1)

MAGHIRANG, R. G. and M. B. MIRANDA. 2001. Garlic Production Guide. Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD), DOST. – (Information Bulletin No. 196). Agriculture Magazine, V(6): 27

MEENA, L. K., S. CHANDRA, A. JHAJHARIA and N. K. RAGHUWANSHI. 2013. Economics of Garlic Production in Baran District of Rajasthan; Break Even Analysis. Asian Journal of Agriculture and Rural Development. 697-701

MELINO, S., R. SABELLI and M. PACI. 2010. Allyl sulfur compounds and cellular detoxification system: effects and perspectives in cancer therapy. Amino Acids.

MINARD, H. R. G. 2012. Effect of Clove Size, Spacing, Fertilisers, and Lime on Yield and Nutrient Content of Garlic (*Allium sativum*). New Zealand Journal of Experimental Agriculture. Volume 6, Issue 2, 1978. pages 139-143

PRIYA CHEMICALS, 2017. Effect of Amino Acids on plants. 2, Larissa, 396 - B, Off: S. Temple Road, Mahim, Mumbai - 400 016, India. http://www.priyachem.com/perliq.htm

REYNOSO, Z. B. 2012. BAR's R&D projects in Ilocos proliferate. Vol. 13 No. 12

ROSARIO, T. L. 1994. Allium Genetic Resources in The Philippines. International Symposium on Alliums for the Tropics.

RUDRAPPA, U. 2009-2015. Garlic Nutrition Facts. www.nutrition-and-you.com

SHALABY, T. A. and H. El-Ramady. 2014. Effect of foliar application of bio-stimulants on growth, yield, components, and storability of garlic (*Allium sativum* L.). Australian Journal of Crop Science

SHEKARI G. and J. JAVANMARDI. 2017. Effects of Foliar Application Pure Amino Acid and Amino Acid Containing Fertilizer on Broccoli (Brassica oleracea L. var. italica) Transplants. Department of Horticultural Science, Shiraz University of Shiraz, Iran.

THE MANILA TIMES, 2014. Ilocos town eyes top garlic producer tag. 2/F Sitio Grande Building 409 A. Soriano Avenue, Intramuros Manila 1002 Philippines.

TRADECORP. 2014. Biostimulants – Amino Acids. Delfan plus. High concentrate amino acid bio-stimulants for improving crop production.

TROY, B. 2015. Non-living plant biostimulants: can they benefit your crops?

UC IPM. 2010. UC Management Guidelines for Pink Root on Onion and Garlic. Ipm.ucdavis.edu.

UMMC, 2017. Vitamin C (Ascorbic acid). University of Maryland Medical Center is a member of the University of Maryland Medical System, 22 S. Greene Street, Baltimore, MD 21201.

USDA. 2014. Nutrition facts for raw garlic, USDA Nutrient Database, version SR-21. Conde Nast. 2014.

WARREN R. 2009. Farmers Forum – It probably came from Gilroy | NJ.com.