GROWTH AND DRY MATTER PARTITIONING OF TOMATO (*Lycopersicon esculentum* Mill.) APPLIED WITH POTASSIUM NITRATE AND PACLOBUTRAZOL UNDER WATERLOGGED CONDITION

JAMES DACUCUS LETCHE

An undergraduate thesis manuscript submitted to the Faculty of the
Department of Crop Science, College of Agriculture,
Central Luzon State University in partial
fullfillment of the requirement
for the degree

BACHELOR OF SCIENCE IN AGRICULTURE
(Crop Science –Horticulture)

JUNE 2017

GROWTH AND DRY MATTER PARTITIONING OF TOMATO (*Lycopersicon esculentum* Mill.) APPLIED WITH POTASSIUM NITRATE AND PACLOBUTRAZOL UNDER WATERLOGGED CONDITION

by

JAMES DACUCUS LETCHE

An undergraduate thesis manuscript presented to the faculty of the
Department of Crop Science, College of Agriculture,
Central Luzon State University in partial
fullfillment of the requirement
for the degree

BACHELOR OF SCIENCE IN AGRICULTURE
(Crop Science-Horticulture)

APPROVED:

ACE MUGSSY L. AGUSTIN
Adviser
6/8/17
Date signed

ROSEMARIE T. TAPIC
Critic
6/11/17
Date signed

PACIFICO T. VIZMONTE Jr.
Department Research Coordinator
6/14/17
Date signed

ROSEMARIE T. TAPIC
Department Chairman
6/14/17
Date signed

ACCEPTED:

ERNESTO A. MARTIN
Dean
6/15/17
Date signed

RECORDED:

RONALDO T. ALBERTO
College Research Coordinator
6/15/17
Date signed

BIOGRAPHICAL SKETCH

The author, James D. Letche was born on the month of February 5th year nineteen hundred and ninety seven at Red Cross Village, Brgy. Joson, Carranglan, Nueva Ecija. He was the youngest child of Mr. Tony L. Letche and Mrs. Josepina D. Letche. He has two older sisters named Analyn and Jocelyn while his older brother named John and Angel.

He finished his elementary in the year 2009 at Baluarte Elementary School in Brgy. R.A. Padilla, Carranglan, Nueva Ecija while he completed his secondary education in year 2013 at Agricultural Science and Technology School (ASTS) in Central Luzon State University, Science City of Munoz, Nueva Ecija.

To reach his goal and fulfil his dream of being a successful agriculturist, he took up Bachelor of Science in Agriculture major in Crop Science with Horticulture as his field of specialization in Central Luzon State University. To further enhance his skills and knowledge, he conducted an undergraduate thesis entitled "Growth and Dry Matter Partitioning of Tomato (*Lycopersicon esculentum* Mill) Applied with Potassium Nitrate and Paclobutrazol Under Waterlogged Condition". His stay in the university enabled him to acquire knowledge and skills needed for a better future.

ACKNOWLEDGEMENT

The author would like to express his sincere gratitude to all persons who extended their generous assistance, support and those who in one way or another greatly contributed to the success of his undergraduate thesis;

To his adviser, Mr. Ace Mugssy L. Agustin for the excellent supervision and for all the teachings and lessons in his undergraduate thesis, as well as those tips to have a successful life and career;

To Dr. Rosemarie T. Tapic, Chairman of the Department of Crop Science; Dr. Ernesto A. Martin, Dean of College of Agriculture; Prof. Pacifico T. Vizmonte Jr., Department Research Coordinator and the entire faculty members in the department for their encouragement and perseverance and for sharing a piece of area in conducting the study.

Endless gratitude to his beloved parents, Mr. Tony L. Letche and Mrs. Josepina D. Letche; to his older brothers, Angel and John; his older sister, Jocelyn for their unconditional love, understanding and support.

To Dr. Chito F. Sace and his wife, Mrs. Evelyn D. Sace for offering free accommodation in their boarding house and additional advices and support in conducting his thesis;

To Manang, Kuya Terong, Kuya Efren and Kuya Sume for their help and advices in proper management of tomato.

To his friends, Lorenzo M. Jacinto Jr., Coralyn Inocencio, Roberto V. Magas Jr., Donn Luigi S. Castro and Venus P. Lagasca, for helping him in the field while he is conducting his thesis;

Above all, to God Almighty, for his guidance and for giving him strength, wisdom and understanding, not only during the conduct of his thesis but also in every second of the author's life.

JAMES DACUCUS LETCHE

TABLE OF CONTENTS

LIST OF TABLES

LIST OF APPENDIX FIGURES

LIST OF APPENDIX TABLES

GROWTH AND DRY MATTER PARTITIONING OF TOMATO (*Lycopersicon esculentum* Mill.) APPLIED WITH POTASSIUM NITRATE AND PACLOBUTRAZOL UNDER WATERLOGGED CONDITION[1/]

by

JAMES DACUCUS LETCHE

ABSTRACT

The general objective of this study was to evaluate the effects of exogenous application of paclobutrazol (PBZ) and potassium nitrate (KNO_3) in tomato subjected to different water regimes. Specifically, it aimed to determine the response of tomato under different water regimes as affected by application of PBZ and KNO_3, and identify the optimum concentration of PBZ and KNO_3 that will give highest survival of tomato in different water regimes. The treatments were: water regime as main plots (non-waterlogged, 24 hrs, and 48 hrs waterlogged) and combination of PBZ (0, 250, 500 ppm) and KNO_3 (0%, 4%, 8%) as sub-plot. Treatments were arranged in split plot in RCBD.

Waterlogging caused reduction in % survival of tomato; however there was no further decrease from 24 hrs to 48 hrs waterlogging. This trend was similar to plant height, number of leaves, leaf dry weight, stem dry weight, plant dry weight, and days to flowering. In terms of PGRs, across WR, highest concentration of PBZ w/o KNO_3 (0% KNO_3 + 500 ppm PBZ) had highest % survival. However, when 500 ppm PBZ combined with 4% and 8% KNO_3 there was reduction in % survival. This was also observed in number of adventitious roots wherein 8% KNO_3 + 500 ppm PBZ had the lowest number of adventitious roots. Plants treated with PBZ and KNO_3 were able to maintain partitioning coefficient in stem when subjected to waterlogged condition. Furthermore, there was decreasing trend in % survival at increasing KNO_3 in different water regimes.

[1/]Undergraduate thesis manuscript presented in partial fulfillment of the requirement for graduation with the degree of Bachelor of Science in Agriculture, Major in Crop Science conducted at the Department of Crop Science area, Central Luzon State University, Science City of Muñoz, Nueva Ecija, under the supervision of Mr. Ace Mugssy L. Agustin with Research Contribution No. CA-04-17-0014

LITERATURE CITED

ALEXANDER LV., ZHANG X., PETERSON TC., CAESAR J., GLEASON B., KLEIN TANK AMG., HAYLOCK M., COLLINS D., TREWIN B., RAHIMZADEH F., TAGIPOUR A., PUPA KUMAR K., REVADEKAR J., GRIFIFTHS G., VINCENT L., STEPHENSON DB., BURN J., AGUILAR E., BRUNET M., TAYLOR M., NEW M., ZHAI P., RUSTICUCCI M., VAZQUEZ- AGUIRRE JL. 2006. Global observed changes in daily climate extremes of temperature and precipitation. J. Geo. Res.

ALLEGRE A., SILVESTRE J., MORARD P., KALLERHOFT J., PINELLI E. 2004. Nitrate reductase regulation in Tomato roots (*Lycopersicon esculentum* Mill.) by exogenous nitrate: a possible role in tolerance to long term root anoxia. J. of Exp. Bot. 55(408) 2625-2634

ASADA K. 1992. Ascorbate peroxidase; a hydrogen peroxide scavenging enzyme in plants. Physiologial Plantarum.*Int. J. Plant Bio.* 85 (2):235-241

ASHRAF MA., ASHRAF MSA., ASHRAF M., ASHRAF MY., QUIRANY FA. 2011. Alleviation of Waterlogging Stress in Upland Cotton (*Gossypium hirsutum)* by exogenous application of potassium in soil and as foliar spray. *Crop and Pasture Science.* 62: 25-48

APEL K., HIRT H. 2004. Reactive Oxygen Species: Metabolism, Oxidative Stress, and Signal Transduction. *Plant Bio.* 55 (1): 379-399

ARMSTRONG W., DREW MC. 2002. Root Growth and Metabolism Under Oxygen Deficiency

ASHRAF M. 2009.Biotechnological approach of improving plant salt tolerance using antioxidants as markers.Biotech. Adv., 27: 84-93.

ASHRAF M., AKRAM NM. 2009. Improving salinity tolerance of plants through conventional breeding and genetic engineering: An analytical comparison. Biotech. Adv., 27: 744-752.

BLOOM AJ., SUKRAPANNA SS., WARNER RL. 1992. Root Respiration Associated with Ammonium and Nitrate Absorption and Assimilation in Barley. *Plant Physio.* 99: 1294-1301

BRADFORD KJ., HSIAO TC.1982 Stomatal behaviour and water relations of waterlogged tomato plants. Plant Physiol. 70, 1508-1513.

BURROWS GE., BOAG TS., STEWART WP. 1992. Changes in Leaf, Stem, and Root Anatomy of Chrysanthemum CV. Lilian Hoek Following Paclobutrazol Application. *J Plant Growth Regul.* 11: 189-194.

DAT J., VANDENABEELE S., VRANOVA E., VAN MANTAGU M., INZE D., VAN BEUSEGEM F. 2000. Dual action of the active oxygen species during plant stress responses. *Cell Mol. Life Sci.*57 (5): 779-795

DE CARVALHO PA., CIRA JMS., DE OLEIVERA LEM., DE CARVALHO JN., DOMICIANO D., CARDENAS HBW. 2015. Nitrate addition improves photosynthesis and flooding tolerance of rubber tree plants. *Aus. J. Crop Sci.* 9 (7):684-689

DREW MC. 1983. Plant injury and adaptation to oxygen deficiency in the root development. A review. 75:179-199

EL-SAID R., EL-FAHD A. 2017. Effect of Growth Retardants on Shoot and Root Development of Stevia (*Steviarebaudina bertoni*) Plant Grown in Vitro. 3: 23-32

ELSE MA., COUPLAND D., DUTTON L., JACKSON MB. 2001. Decreased root hydraulic conductivity reduces leaf water potential, initiates stomatal closure and slows leaf expansion in flooded plants of castor oil (*Riccinus communis*) despite diminished delivery of ABA from the roots to shoots in the xylem sap. *Physiol. Plant*, 111: 46-54.

FLETCHER RA., HOLSTRA G. 1985. Triamederon : a plant multi-protectant. *Plant Cell Physiology*. 26: 775-780

FLETCHER RA., ARNOLD V. 1986. Stimulation of cytokinins and chlorophyll synthesis in cucumber cotyledons by triamedeferon. Physiol Plant. 66: 197-201.

GAMBRELL RP., PATRICK JR. WH. 1978. Chemical and microbiological properties of anaerobic soils and sediments.*Plant life in anaerobic environment.* p. 375-423

GUARDIOLA JL., BARRES MT., ALBERT C., GARCIA-LOUIS A. 1993. Effects of exogenous growth regulators on fruit development in Citrus unshiu. *Annals of Botany*. 71 (2) 169-176.

HABIBZADEH F., SOROOSHZADEH A., PIRDASHTI H., MODARES-SONAVY SAM. 2013. Alleviation of waterlogging damage by foliar application of nitrogen compounds and tricyclazole in canola. *Aus J of CroSci*. 401-406

HADDAD M., BANI-HANI NM., AL-TABBAL JA., AL FRAIHAT AH. 2016. Effect of different potassium nitrate levels on yield and quality of potato tubers. *J. of Food and Agri. Envi.* 14 (1):101-107

HORCHANI F., KHAYATI H., RAYMOND P., BROUGUIRRE R., SMITI SA., 2009. Contrasted Effects of Prolonged Root Hypoxia on Tomato Root and Fruit (*Solanum lycopersicum L.)* Metabolism. J of Agron. Crop Sci. p.313-315

HIRON RWP., WRIGHT STC. 1973. The role of endogenous abscisic acid in the response of plants to stress. J. Exp. Bot. 24:769-781.

JAISWAL A., STRIVASTAVA. 2005. Effect of nitric oxide on some morphological and physiological parameters in maize exposed to waterlogging stress. *African J of Agri Research.* 10 (35): 3462-3471

KARUPPANAPADIAN T., MOUNJC., KIM C., MANOHORAN., KIM W. 2011. Reactive oxygen species in plants; their generation, signal transduction and scavenging mechanisms. *Aus. J. Crop Sci.* 5 (6):709-725

KRAMER PJ. 1951. Causes of injury to plants resulting from flooding of the soil. *Plant Physiol.* 26: 722-736.

LIN K.R., WENG C., LO H., CHEN J. 2004.Study of the root antioxidant system of tomatoes and eggplants under waterlogged conditions. *Plant Sci.* 167: 355-365

LYNDOLPH, PE. 1985. Weather and Climate. Rowman and Allanheld; editors. Littlefield Adams and Company. P.2-66

MALIK AI., COLMER TD., LAMBERS H., SCHORTEMEYER M. 2001. Changes in physiological and morphological traits of roots and shoots of wheat in response to different depths of waterlogging. Aus J. of Plant Physio. 28 (11): 1121-1131.

MCDANIEL. 1996. Developmental Physiology of Floral Initiation in Nicotiana tabacum L. *J Exp Bot.* 47 (4): 465-475.

MC NAMARA S., MITCHELL C. 1991. Roles of Auxin and Ethylene in Adventitious Root Formation by a Flood- resistant Genotype. *Hort. Sci.* 20 (1): 57-58

MEHLHORN H., LELANDAIS M., KURTHHG., FOYER C. 1996. Ascorbate is the natural substrate for plant peroxidases. *Febs Letters*. 378 (3): 203-206

NAGAO MA., NISHINA. nd. Use of Potassium Nitrate on Mango Flowering.

PAGASA-DOST. Climate Change in the Philippines. Retrieved November 10, 2016. http://pagasa.dost.gov.ph/

SCHWARZ D., THOMPSON A., KLARING H. 2014. Guidelines to use tomato in experiment with a controlled environment. *Plant Sci*. 5(625)

SOJKA RE. 1992. Stomatal closure in oxygen-stressed plants. William and Wilkins.J of Soil Sci.

SOPHER CR. 1998. Paclobutrazol-induced Changes Associated with Stress Protection in Maize seedlings. *National Library of Canada.*

STOIMENOVA M., IGAMBERDIEV AV., GUPTA KJ. 2007. Nitrite Driven Anaerobic ATP Synthesis in Barley and Rice root mitochondria. *Planta*. 262 (2) 465-474

TA- LIAO C., HO LIN C. 2001. Physiological Adaptation of Crop Plants to Flooding Stress.*Proc. Natl. Sci. Coun.*ROC (B). 25: 148-157

TSEGAW T., HAMMES S., ROBERTSE J. 2005. Paclobutrazol-induced Leaf, Stem, and Root Anatomical Modifications in Potato. *HortScience*. 40 (5): 1343-1346.

YIU JC., LIU CW., KUO CT, TSENG YL., LAI WJ. 2008. Changes in anti-oxidant properties and their relationship to paclobutrazol-induced flooding tolerance in Welsch Onion. *J of the Science of Food and Agri*. 88: 1222-1230.

YU KW., GAO WY., HAHN EJ., PAEK KY. 2001. Effect of macroelements and nitrogen source on adventitious root growth and ginsenoside production in ginseng (*Panax ginseng* CA Meyer*). J of Plant Bio*. 44 (4): 179-184.

WATERS I., KUIPER PJC., WATKIN E., GREENWAY H. 1991. Effects of anoxia on wheat seedlings. I. *Interaction between anoxia and other environmental factors*. J. Exp. Bot. 42:1427–35.