NANOSTRUCTURE SOIL CONDITIONER ENRICHED WITH *Lactobacillus plantarum* UTILIZING SQUASH (*Cucurbita maxima)* SEEDS AS SOURCE OF PHOSPHORUS AND SWEET POTATO (*Ipomoea batatas)* AS SOURCE OF POTASSIUM

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ACCEPTANCE SHEET

This undergraduate thesis entitled "**NANOSTRUCTURE SOIL CONDITIONER ENRICHED WITH *Lactobacillus plantarum* UTILIZING SQUASH (*Cucurbita maxima)* SEEDS AS SOURCE OF PHOSPHORUS AND SWEET POTATO (*Ipomoea batatas)* AS SOURCE OF POTASSIUM**" prepared and submitted by **ANNE KRISTEL L. NICOLAS**, in partial fulfillment of the requirements for the degree of **BACHELOR OF SCIENCE IN BIOLOGY (MICROBIOLOGY)**, is hereby accepted.

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BIOGRAPHICAL SKETCH

The author of this paper is Anne Kristel L. Nicolas, 20 years old she was born on September 21 1997 in Brgy. San Juan, Umingan, Pangasinan. Her parents are Mr. Rolando R. Nicolas and Mrs. Anilyn L. Nicolas. She spent her elementary years in San Juan Elementary School, Umingan, Pangasinan from 2005-2010; secondary level in Rosales National High School, Umingan, Pangasinan from 2010-2014 and now she is taking her college degree with the course of Bachelor of Science in Biology, Major in Microbiology at Central Luzon State University, Science City of Muñoz, Nueva Ecija from the year 2014 up to the present.

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ABSTRACT

NICOLAS, ANNE KRISTEL L., Department of Biological Sciences, College of Arts and Sciences, Central Luzon State University, Science City of Munoz, Nueva Ecija, Philippines, **JUNE 2018, NANOSTRUCTURE SOIL CONDITIONER ENRICHED WITH *Lactobacillus plantarum* UTILIZING SQUASH (*Cucurbita maxima)* SEEDS AS SOURCE OF PHOSPHORUS AND SWEET POTATO (*Ipomoea batatas)* AS SOURCE OF POTASSIUM**

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Soil conditioner from organic material could be a good idea to work on and also it could be used as an alternative for chemical fertilizers and remedies in order to limit the side effects that cause destruction to the environment. Considering the effects of external organic and inorganic components on soil fertility and quality is really important for the improvement of low-yielding soils. And with the use of Nanotechnology from this study, it focused on the enrichment of the soil conditioner with 6 different treatment by incorporating the *Lactobacillus plantarum* using squash (*Cucurbita maxima*) seeds as source of phosphorus and sweet potato (*Ipomea batatas*) as source of potassium. Where the NPK content was analyzed and evaluated the bacterial cell count in comparison in the initial and final fermentation process. The plant extracts is not that powerful in enhancing the FAA, since FAA alone is significantly better in term of the NPK value from the other treatments. However in terms of bacterial succession, the T4 (FAA+PK+silica) and T6 (FAA+PK+silica+ *L. plantarum*) proves to be higher than the other treatments which only suggest that there is a good fermentation process.

LITERATURE CITED

Alghuthaymi, M.A., Almoammar, H., Rai, M., Galiec, E.S. & Elsalam, K.A.A (2014). Agriculture and environmental biotechnology myconanoparticles: synthesis and their role in phytopathogens management. *Biotechnology and Biotechnological Equipment*, 29 (2), 221-236.

Amoo, I.A., Eleyinmi, A.F., Ilelaboye, N.O.A. & Akoja, S.S. (2004). Characterization of oil extracted from gourd (*Cucurbita maxima). Food, Agriculture and Environment,* 2(2), 38-29.

Arena, M.P., Silvain, A., Normanno, G., Grieco, F., Drider, D., Spano, G. & Fiocco , D. (2016). Use of *Lactobacillus plantarum* strains as bio-control strategy against food-borne pathogenic microorganisms. *Frontiers in Microbiology*, 7, 1-10.

Ashley, M.K., Grant, M. & Grabov, A. (2006). Plant response to potassium deficiencies: a role of potassium transport proteins. *Journal of Experimental Botany*, 57(2), 425-436.

Aywa, A.K., Nawiri, M.P. & Nyambaka, H.N. (2013). Nutrient variation in colored varieties of *Ipomea batatas* grown in Vihiga country, Western Kenya. *International Food Research Journal*, 20(2), 819-825.

Balraj, T.H., Palani, S. & Arumugan, A. (2014). Influence of gunapaselam, a liquid fermented fish waste on the growth characteristics of *Solanum melongena. Journal of Chemical and Pharmaceutical Research*, 6(12), 58-66.

Banik, S. & Sharma, P. (2011). Plant pathology in the era of nanotechnology. *Journal of Indian Phytopathology*, 64 (2), 120-127.

Bhardwaj, D., Ansari, M.W., Sahoo, R.K. & Tuteja, N. (2014). Biofertilizer function as a key player in sustainable agriculture by improving soil fertility, plant tolerance and crop productivity. *Microbial Cell Factories*, 1, 1-10.

Bull, M.J., Jolley, K.A., Bray, J.E., Aerts, M., Vandamme, P., Maiden, M.C.J., Marchesi, J.R. & Mahenthiralingam, E. (2014). The domestication of the probiotic bacterium *Lactobacillus Plantarum. Scientific Reports*, 1, 1-8.

Chandrasekara, A. & Kumar, T.J. (2016). Roots and tuber crops as functional foods: a review on phytochemical constituents and their potential health benefits. *International Journal of Food Science*, 1, 1-15.

Cushnie, T.P. & Lamb, A.J. (2005). Antimicrobial activity of flavonoids. international *Journal of Antimicrobial Agents*, 26(5), 343-356.

De Boodt, M.F. (1990). Applications of polymeric substances as physical soil conditioners. *Soil Colloids and Their Associations in Aggregates*, 214, 517-556.

Demoling, F., Figueroa, D. & Baath, E. (2007). Comparison of factors limiting bacterial growth in. *Soil Biology and Biochemistry,* 39(10), 2485-2495.

Dubey, S.D. (2012). Overview of *Cucurbita maxima. International Journal of Phytopharmacy*, 2(3), 68-71

Duhan, J.S, Kumar, R., Kumar, N., Kaur, P., Nehra, K., & Duhan, S. (2017). Nanotechnoloy: The new perspective in precision agriculture. *Biotechnology Report,* 15, 11-23.

Encyclopedia of Food And Culture. (2017). Sweet Potato. Retrieved from: Http://Www.Encyclopedia.Com/Plants-And-Animals/Plants/Plants/Sweet-Potato.

Grant, C., Bittman, S., Montreal, M., Plenchette, C. & Morel, C. (2005). Soil and fertilizer phosphorus: effects on plant p supply and mycorrhizal development. *Canadian Journal of Plant Science*, 85, 3-4.

Habib, A., Biswas, S., Siddique, A.H., Manirujjaman, M., Uddin, B., Hasan, S., Khan, M.M.H., Uddin, M., Islam, M., Hasan, M., Rahman, M., Asaduzzama, M., Rahman, S.M., Khatun, M., Islam, M.A. & Rahman, A. (2015). Nutritional and lipid composition analysis of pumpkin seed (*Cucurbita maxima Linn.*). *Journal of Nutrition and Food Sciences*, 5(4), 1-6.

Iler, R. K. (1979). The chemistry of silica: solubility, polymerization, colloid and surface properties, and biochemistry. *Journal of Biochemistry,* 2, 4-6

Johnston, A.E. & Steen, I. (2000). Understanding phosphorus and its use in agriculture. *European Fertilizer Manufacturers Association (EFMA), Brussels*, 1, 1-40.

Khan, M.R. & Rizvi, T.F. (2014). Nanotechnology: scope and application in plant disease management. *Asian Network for Scientific Information*, 13(3), 214-231.

Kiselev, A. (1959). Surface chemical compounds and their role in adsorption phenomena. *US Atomic Energy Commission, Technical Information Service,* 3750, 24967-24975

Kleerebezem, M., Boekhorst, J., Kranenburg, R.V., Molenaar, D., Kuipers, O.P., Leer, R., Tarchini, R., Peters, S.A., Sandbrink, H.M., Fiers, M..W.E., Stiekema, W.,

Lankhorst, R.M.K., Bron, P.A., Hoffer, S.M., Groot, M.N.N, Kerhoven, R., de Vries, M., Ursing, B., de Vos, W.M. & Siezen, R.J. (2002). Complete genome sequence of *Lactobacillus plantarum* WCF1. *Proceeding of the National Academy of Sciences*, 100(4), 1990-1995.

Lema, A. & Degebassa, A. (2013). Coparison of chemical fertilizer, fish offal's fertilizer and manure applied to tomato and onion. *African Journal of Agricultural Research*, 8(3), 274-278.

Liu, Z., Rong, Q., Zhou, W. & Liang, G. (2017). Effects of inorganic and organic amendment on soil chemical properties, enzyme activities, microbial community and soil quality in yellow clayey soil. *Public Library of Science,* 1-20.

Lui, L., Zhang, T., Gilliam, F.S., Gundersen, P., Zhang, W., Chen, H., & Jiangmeng, M. (2013). Interactive effects of Nitrogen and Phosphorus on soil microbial communities in a tropical forest. *Public Library of Science One,* 8(4), 1-10.

Manjunatha, S.B., Biradar, D.P. & Aladakatti, Y.R. (2016). Nanotechnology and its applications in agriculture: a review. *Journal of Farm Science*, 29 (1), 1-13.

Marczak, B.K., Sawicka, B., Supski, J., Cebulak, T. & Paradowska, K. (2014). Nutritional value of the sweet potato (*Ipomea Batatas (L.)* Lam) cultivated in South-Eastern Polish conditions. *International Journal of Agronomy and Agricultural Research*, 4(4), 169-178.

Mbaeyi-Nwaoha, I. E. & Emejulu, V. N. (2013). Evaluation of phytochemical composition and antimicrobial activity of sweet potato (*Ipomea Batatas*) Leaf. *Pakistan Journal of Nutrition*, 12, 575-568.

Mythili, P. & Kavitha, T. (2017). Overview on *Cucurbita maxima* seed. *Journal of Dental and Medical Sciences,* 16, 29-33.

Naz, S., Naqvi, S.A.R., Khan, Z.A., Mansha,A., Ahmad,M., Zahoor, A.F. & Hussain, A. (2017). Antioxidant, antimicrobial and anti proliferative activities of peel and pulp extracts of red and white varieties of *Ipomea Batatas* (L) Lam. *Tropical Journal of Pharmaceutical Research,* 16(9), 2221-2229.

Neelamma, G., Swamy, B.D. & Dharmodaran, P. (2016). Phytochemical and pharmacological overview of *Cucurbita maxima* and future perspective as potential phytotherapeutic agent. *European Journal of Pharmaceutical and Medical Research,* 3(8), 277-287.

Paulette, L., Filipov, F., Oroian, I., Mihalache, M., Odagiu, A. & Buta, M. (2014). Use of soil conditioner in greenhouse soil. *Pro Environment Journal,* 7, 185-189.

Prajapati, K. & Modi, H.A. (2012). The importance of potassium in plant growth - a review. *Indian Journal of Plant Sciences*, 1(2-3), 177-186.

Rashid, M.I., Mujawar, L.H., Shahzad, T., Almeelbi, T., Ismail, I.M.I. & Oves, M. (2016). Bacteria and fungi can contribute to nutrients bioavailability and aggreagate formation in degraded soils. *Microbiological Research,* 183, 26-41.

Ravishankar, K., Kiranmayi, G.V.N., Reddy, A., Sowjanya, V.V.L., Sainadh,V.B., Durga, V.G.L., Prasad, V.S., Swaminaidu, P.V. & Prasad, T. (2012). Preliminary phytochemical screening and in-vitro antibacterial activity of *Cucurbita maxima* seed extract. *International Journal of Research in Pharmacy and Chemistry,* 2(1), 86-91.

Ren, H., Hu, J., Hu, Y., Yang, G. & Zhang, Y. (2017). Divergence of compost extract and bio-organic manure effects on lucerne plant and soil. *Peer-Reviewed Scientific Mega Journal,* 1-14.

Robertson, R. (2017). 9 Ways *Lactobacillus Plantarum* can benefit your health. Retrieved from: Http://Www.Healthline.Com/Nutrition/Lactobacillus-*Plantarum*.

Sahebi, M., Hanafi, M.M., Akmar, A.S.N., Rafii, M.Y., Azizi, P., Tengoua, F.F., Azwa, J.N.M. & Shabanimofrad, M. (2015). Importance of silicon and mechanism of biosilica formation in plants. *Biology Medicine Research International*, 1, 1-16.

Schaffer, A.A. & Paris, H.S. (2003). Melons, squashes and gourds. *Encyclopedia of Food Sciences and Nurtrition,* 2, 3817-3826.

Sela, G. (2017). Potassium in plants. Smart Fertilizer Management. Retrieved From: Http://Www.Smartfertilizer.Com./Articles/Potassium-In-Plants.

Shekhar, S., Mishra, D., Buragohain, A.K., Chakraborty, S. & Chakraborty,N. (2015). Comparative analysis of phytochemicals and nutrient availability in two constrasting cultivars of sweet potato (*Ipomea batatas* L.). *Food Chemistry*, 173, 957-965.

Sultenfuss, J.H. (1999). Functions of phosphorus in plants. *Better Crops with Plant Food*, 83(1), 6-7.

Thuadaij, N. & Nuntiya, A. (2008). Preparation of nanosilica powder from rice husk ash by precipitation method. *Chiang Mai Journal Science*, 35, 206-211.

Umamaheswari, T., Srimeena, N., Vasanthi, N., Cibichakravarthy, B., Anthoniraj, S. & Karthikeyan, S. (2016). Silica as biologically tranmutated source for bacterial growth silimilar to carbon. *Matters Archive,* 1-5.

'ang, M., Zheng, Q., Shen, Q. & Guo, S. (2013). The critical role of potassium in plant stress response. *International Journal of Molecular Sciences*, 14, 7370-7390.

akaria, A.A.B. (2009). Growth optimization of potassium solubilising bacteria isolated from biofertilizer. *Faculty of Chemical and Natural Resources Engineering Universiti Malaysia Phang*, 1-3.

uravlev, L.T. (2000). The surface chemistry of amorphous silica: Zhuravlev model. *Physicochemical and Engineering Aspects*, 173, 1-38.