INFLUENCE OF ACOUSTIC WAVES ON THE SHELF LIFE QUALITY OF MATURE MANGO *(Mangifera indica* L. *var. kalabaw)*

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An Undergraduate Thesis Submitted to the Faculty of the Department of Agricultural and Biosystems Engineering, College of Engineering, Central Luzon State University, Science City of Muñoz, Nueva Ecija, Philippines in Partial Fulfillment of the Requirements for the Degree of

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ACCEPTANCE SHEET

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BIOGRAPHICAL SKETCH

The researcher of the study, Kimberly S. Matias was born on June 21, 1997 in Cabanatuan City and now living with her family at Malayantoc Sto. Domingo Nueva Ecija. She is the eldest child of Venancio Matias and Digna Matias. She has a younger brother named Hero S. Matias.

She finished her primary education at Malayantoc Elementary School and received the award for being the class Salutatorian and other special awards. She took her secondary education at Santo Domingo National Trade School and received the National Certificate for completing the vocational course of Garment Technology. Year 2014, her parents sent her to Central Luzon State University to take the degree of Bachelor of Science in Agricultural and Bio-systems Engineering. Although it's not her passion in life, but she claimed that there will always be a demand for skilled engineers especially in the field of agriculture and she can assure herself for a better and brighter future.

She is not only academically inclined but she is also good in other field such as sport. She is a member of student athletes. She is an active player of Karatedo. She had medals and certificate for winning the competition such as University Intramurals and SUC-III Olympics (SCUAA).

Finally, she is also a member of various organizations namely; the Singles for Christ (SFC) and Maharlika Karatedo Kai of the Philippines International as brown belt.

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ABSTRACT

MATIAS, KIMBERLY SADIE, Department of Agricultural and Biosystems Engineering, Central Luzon State University, Science City of Muñoz, Nueva Ecija, Philippines, **JUNE 2019, INFLUENCE OF ACOUSTIC WAVES ON THE SHELF LIFE QUALITY OF OF MATURE MANGO *(Mangifera indica L. var. kalabaw)***

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Nowadays, Philippines facing the major problem in agriculture sector, which is the post-harvest lost due to short shelf life of perishable crops. This study aimed to determine the influence of acoustic waves on the shelf life quality of mature mango. Specifically, it aimed to determine the time of exposure that will give the optimum marketable quality of mature mango. Prior to storage, mature mango samples were subjected to acoustic wave 1 KHz at100 dB.

Mature mango fruits from the farm were exposed to acoustic waves at different levels: T1 (control treatment) – zero exposure; T2 – 4 hours of exposure; T3 – 6 hours of exposure; and T4 – 8 hours of exposure. Subsequently, mature mango were stored in a chiller at 10° C. Considering the surface color, total soluble solids content and flesh firmness, the optimum exposure time of mature mango to acoustic waves that can give the best physicochemical and mechanical properties was determined.

Result showed that under zero exposure, samples were marketable until the 11th day of storage. Four hours of exposure gave the best physicochemical and mechanical property of mature mango. It also gave the optimum shelf life of the mature mango quality with 23 days. On the other hand, additional marketable days of 9, 6 and 3 for exposure time of 4 hours, 6 hours and 8 hours, respectively.

Over all, it can be concluded that the most effective treatment in this study was the Treatment 2 (4 hours of exposure). Moreover, acoustic waves effectively slowed down the ripening and deterioration of the mango.

Keywords: Acoustic waves, frequency, amplitude, mature mango, shelf life

LITERATURE CITED

AGRONIGERIA, 2016. Reducing post-harvest losses of perishable food crops. The voice of Nigeria's Agriculture. Retrieved from https://www.agronigeria.com.ng/reducing-post-harvest-losses-perishable-food-crops/

ADEL K.A. 2013. "Mango". Postharvest Center. Department of Plant Sciences, University of California. Retrieved on January 17, 2019. Access at http://postharvest.ucdavis.edu/Commodity_Resources/Fact_Sheets/Datastores/Fruit_English/?uid=37&ds=798

ARNOLD, B. 2018. The Working Principle of Colorimeters. Editorial feature. Azo Sensors. Retrieved at https://www.azosensors.com/article.aspx?ArticleID=324.

ASUNCION, D.P. 2017. The Innfluence of Acoustic Waves on the Shelf Life Quality of Broccoli *(Brassica oleracea var. italic)*. (Published undergraduate thesis). Central Luzon State University. College of Engineering.

BALDIVIANO, F.P. et. al.1999. "Variation in polyphenol profile and content of different strains of mango (Mangifera indica L.) var. carabao and effects of environment". Philippine Journal of Crop Science (Philippines). Retrieved January 17,2019.

BALLY, I. 2006. Mangifera indica (mango). Species Profiles for Pacific Island Agroforestry.(pp.4). Retrieved from http://www.vegetableipmasia.org/uploads/files/20140923/files/Mangifera-mango.pdf

BAYARONG, A. 2011. "Farmers urged to produce sweet mangoes for export". Sun Star Pampanga. Retrieved Janaury 17, 2019.

BOCHU, W., JIPING, S., BIAO, L., JIE, L., CHUANREN, D., 2004. Sound wave stimulationtriggers the content change of the endogenous hormone of the Chrysanthemummature callus. Colloids Surf. B 37 , 107–112.Braam, J., 2004. In touch: plant response to mechanical stimuli. New Phytol. 165,373–389.

CHOUDHARY R. 2004. Frequency. The physics Factbook. Retrieved on January 8, 2019 at https://hypertextbook.com/facts/2003/ChrisDAmbrose.shtml

CSANYI, C. 1973 "Stage of Maturity for Mangoes." Home Guides | SF Gate, http://homeguides.sfgate.com/stage-maturity-mangoes-98526.html.

EUSEBIO, J.E. "Overview of the selected tropical fruit in the Philippines". Director of the Crops Research Division of the Philippines Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD) of the Department of Science and Technology (DOST), Los Baos, Laguna 4030, Philippines. Retries January 21, 2019.

JUDY, R. 2004. A Comparison of Data loggers, Onset Computer Corporation. Retrieved at http://www.myanmar-education.edu.mm/wp-content/uploads/2013/05/24_Hla_Hla_Htay.pdf.

KADER, A. 1997. Mango. Post-harvest Center. Department of Plant Sciences, University of California, Davis. Retrieved from http://postharvest. ucdavis.edu/Commodity_Resources/Fact_Sheets/Datastores/Fruit_English/?uid=37&ds=798

KADER, A., THOMPSON, J., SYLVA, K. AND HARRIS, L. 2012. STORING Fresh Fruits and Vegetables for Better Taste. University of California-Davis Postharvest Technology Research and Information Center. http://ucce.ucdavis.edu/files/datastore/234-1920.pdf.

KADIS, J. 2015. Acoustics: the study of sound waves. (pp.1). Retrieved at https://ccrma.stanford.edu/courses/192a/Lecture1-Acoustics.pdf

KAREN, L.B. 2001. Storage Conditions: Fruits & Vegetables. Bulletin #4135, Storage Conditions: Fruits & Vegetables. Kansas State University Cooperative Extension Service, Manhattan. Retrieved at https://extension.umaine.edu/publications/4135e/.

KLATZ, SUSAN. 2007 "How Long From Blossom to Fruit for a Mango Tree?" Home Guides | Retrieved from http://homeguides.sfgate.com/long-blossom-fruit-mango-tree-58667.html.

KIM, J. et.al. (2015). Sound waves delay tomato fruit ripening by negatively regulating ethylene biosynthesis and signaling genes. Postharvest Biology and Technology. 110. 43-50. 10.1016/j.postharvbio.2015.07.015. Retrieved at https://www.researchgate.net/publication/282286677_Sound_waves_delay_tomato_fruit_ripening_by_negatively_regulating_ethylene_biosynthesis_and_signaling_genes.pdf.

KAYS, S.J. (1991): Post harvest physiology of perishable plant products. New York: Van Nostrand Reinhold. Retrieved from https://www.degruyter.com/downloadpdf/j/agro.2011.28.issue-2/v10146-011-0013-8/v10146-011-0013-8.pdf

KEMPER W.T. 2019. Storage of Fruits and Vegetable. Missouri Botanical Graden.

LEE, J. et.al. (2015). Sound waves delay tomato fruit ripening by negatively regulating ethylene biosynthesis and signaling genes. Postharvest Biology and Technology. 110. 43-50. 10.1016/j.postharvbio.2015.07.015. Retrieved at https://www.researchgate.net/publication/282286677_Sound_waves_delay_tomato_fruit_ripening_by_negatively_regulating_ethylene_biosynthesis_and_signaling_genes.pdf.

LEHMAN, S. 2019. Mangos Are Not Only Delicious, But Are Nutritious as Well. Medically reviewed by a board-certified physician. Retrieved from https://www.verywellfit.com/mango-calories-and-nutrition-facts-3982611

MCWILLIAMS M., 2017. Foods: Experimental Perspectives. 8th Edition.California State University, Los Angeles, Pearson". Missing or empty |url= (help).

MORTON, J.F. (1987). Mango. In: Fruits of Warm Climates. NewCROP, New Crop Resource Online Program, Center for New Crops & Plant Products, Purdue University. pp. 221–239. ISBN 0-9610184-1-0.

PANGILINAN, JR.L. (3 October 2014). "In Focus: 9 Facts You May Not Know About Philippine National Symbols". National Commission for Culture and the Arts. Retrieved 8 January 2019.

PHILIPPINE STATISTICS AUTHORITY. 2018.Major Vegetables and Root Crops Quarterly Bulletin, July-September 2018/Mango. Retrieved at https://psa.gov.ph/fruits-crops-bulletin/mango

RAMOS, D.B. 2017. The Innfluence of Acoustic Waves on the Shelf Life Quality of Cauliflower *(Brassica oleracea var. botrytis)*.(Published undergraduate thesis). Central Luzon State University. College of Engineering.

RAO, C. 2015. Engineering for storage of fruits and vegetables. The boulevard, Langford Lane, Kidlington, Oxford OX5 1GB, UK.

REYES, R. 2014 "PMSFC modernizing mango farming in PHL". Business Mirror. Archived from the original on 8 August 2014. Retrieved 17 January 2019.

SCHUTZKI, R.E.; CREGG, B. 2007. "Abiotic plant disorders: Symptoms, signs and solutions. A diagnostic guide to problem solving" (PDF). Michigan State University Department of Horticulture. Michigan State University.

SHUBROOK, N. August 2018. "The Health Benefits of Mango". BBC Good Food. Retrieved on January 17, 2019. Access at https://www.bbcgoodfood.com/howto/guide/health-benefits-mango