

**PERFORMANCE OF GROWING NATIVE PIGS FED DIET WITH WATER
SPINACH (*Ipomoea aquatica*)**

ANGELO C. DIONIDO

An undergraduate thesis manuscript presented to the faculty of the Department of
Animal Science, College of Agriculture in partial fulfillment
of the requirements for the degree

**BACHELOR OF SCIENCE IN AGRICULTURE
(Animal Science)**

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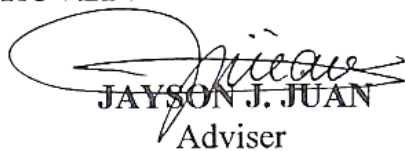
**PERFORMANCE OF GROWING NATIVE PIGS FED DIET WITH WATER
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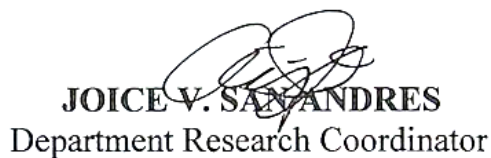
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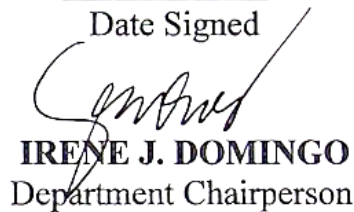
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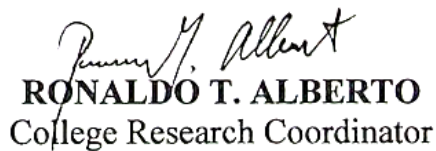
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BIOGRAPHICAL SKETCH

The author, Angelo Capellan Dionido was born on August 12, 1996 in Manila Sanitarium Doctors (now called Adventist Medical Center Manila) in Pasay City, Manila. He is the youngest son of Mr. Gerardo C. Dionido and Damiana C. Dionido.

The author grew up in Biñan, Laguna wherein he finished his pre-school, elementary and high-school education in Colegio San Agustin – Biñan, where he became active in the religious organizations in the school. The author took several college admission tests in universities such as De La Salle University – Dasmariñas, University of Santo Tomas, and University of the Philippines – Los Baños. Due to financial problems, the author did not enroll in the said universities but opportunity came when the filing for admission test in Central Luzon State University was extended. On June 2013, he enrolled at Central Luzon State University wherein he took Bachelor of Science in Agriculture, major in Animal Science.

Struggling at first in grasping the science aspect of the course, his father and the uniqueness of this line of work compared to other disciplines inspired the author to pursue Agriculture as his stream. Amidst of the different endeavours the author has experienced, he bravely lived independently away from his hometown and parents and learned how to cope up with the hardships in being a college student in which he eventually completed the Certificate of Agriculture last April 2015 and graduated in June 2017.

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PERFORMANCE OF GROWING NATIVE PIGS FED DIET WITH WATER SPINACH (*Ipomoea aquatica*)¹

by

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ABSTRACT

A total of 12 growing native pigs with mean body weight of 5.10 kg were used in the study to assess the feeding value of water spinach in terms of growth performance and income over feed cost.

The dietary treatment used in the study were composed of fresh or ensiled water spinach as protein source and rice bran as energy source supplemented with limestone, salt, vitamin and mineral premix, poultry by-product meal, molasses and ethoxyquin. Feeding was done twice a day and adjustments on the amount of feed to be offered were based on the amount of feed leftover.

Results disclosed that the body weight gain, feed conversion ratio (FCR) and feed intake of the pigs at any feeding period did not differ significantly ($P>0.05$) irrespective of the diets. The economic analysis indicated that pigs fed diet with fresh water spinach had a numerically higher income over feed cost.

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LITERATURE CITED

- BAER D. J., W. V. RUMPLER, C. W. MILES, and G. C. FAHEY JR.** Dietary Fiber Decreases the Metabolizable Energy Content and Nutrient Digestibility of Mixed Diets Fed to Humans. *J Nutr.* 1997 Apr;127(4):579-86.
- BONDOC, O. L. and S. M. RAMOS.** 1998. Findings of a survey of native pigs in some provinces of the Philippines. University of the Philippines – Los Baños, Laguna. Abstract. Retrieved February 2016 from agris.fao.org.
- BUI HUY NHU PHUC,** 2000. Tropical forages for growing pigs. PhD Thesis, Agraria 247. Swedish University of Agricultural Sciences, ActaUniversitatisAgriculaeSueciae.
- BUSINESS DIARY PHILIPPINES.** 2016. Raising Native Animals. Retrieved February 2016 on <http://businessdiary.com.ph/6301/raising-native-animals/>.
- CABARLES, J.** 2007. Effect of industrialized animal production in the livestock industry of the Philippines and to the livelihood of marginal farmers. Cited in CALLO-ETIS, V. N. 2015. Economic potential of raising Philippine native pigs on *Trichanthera (Trichantheragigantea)* diets. *IAMURE International Journal of Business and Management.* 10: pp. 1-18.
- CALLO-ETIS, V. N.** 2015. Economic potential of raising Philippine native pigs on *Trichanthera (Trichantheragigantea)* diets. *IAMURE International Journal of Business and Management.* 10: pp. 1-18.
- CHHAY TY and T. R. PRESTON.** 2005. Effect of water spinach and fresh cassava leaves on growth performance of pigs fed a basal diet of broken rice. Retrieved July 31, 2016 from http://pigtrop. Cirad.fr/en/scientific/alim_LRRD03005_1.htm.
- CHIV PHINY, B. OGLE, T. R. PRESTON, and K. BORIN.** 2008. Growth performance of pigs fed water spinach or water spinach mixed with mulberry leaves, as protein sources in basal diets of cassava root meal plus rice bran or sugar palm syrup plus broken rice. Centre for Livestock and Agriculture Development. Tosoly UTA – Colombia. Retrieved July 31, 2016 from <http://www.lrrd.org/lrrd20/supplement/phin2.htm>.
- CROMWELL, G. L.** 2015. Nutritional Requirements of Pigs. *The Merck Veterinary Manual.* Retrieved February 2016 from www.msdsvetmanual.com/management-and-nutrition/nutrition-pigs/nutritional-requirements-of-pigs.htm

- DUNG, N. N. X., L. H. MANH, T. V. PHUOC, P. UDEN, and B. OGLE.** 2006. The effect of substituting a basal diet for growing pigs with fresh forages on apparent digestibility and nitrogen retention. Workshop seminar: Workshop on Forages for Pigs and Rabbits MEKARN CelAgrid – Cantho University, Vietnam.
- FEEDIPEDIA.** 2012. Feedipedia, a programme by INRA, CIRAD, AFZ and FAO. Retrieved February 2016 from <http://feedipedia.org>.
- FEEDIPEDIA.** 2012. water spinach (*Ipomoea aquatica*). Feedipedia, a programme by INRA, CIRAD, AFZ and FAO. Retrieved February 2016 from <http://www.feedipedia.org/node/136>.
- FOOD AND AGRICULTURE ORGANIZATION (FAO).** 2003. Philippine native pig population. FAO (<http://dad.fao.org/>). Cited in MONLEON, A. 2014. Empowering Technology for Pig Breeding – Philippines & Taiwan, TLRI.
- FOOD AND FERTILIZER TECHNOLOGY CENTER (FFTC).** 2010. Utilization of native animals for building rural enterprise in warm climate zone. pp. 25-27. Cited in OCTURA, J., R. YAMBAO, R. SANTIAGO, B. CHOD, and R. VEGA. 2014. Polymorphism in the melanocortin-4 receptor (MC4R) gene and its effect on fatness and weight performance of Philippine native pigs: A preliminary study. International Journal of Sciences: Basic and Applied Research (IJSBAR) 15: 464-474.
- GEROMO, F.** 1993. Survey and evaluation of indigenous pig production and management practices in the Zamboanga Peninsula. University of the Philippines – Los Baños, Laguna. Abstract. Retrieved February 2016 from DOST SciNet-Phil.
- GÖHL, B.,** 1982. Les aliments du bétail sous les tropiques. FAO, Division de Production et Santé Animale, Roma, Italy. Cited in Feedipedia.org by HEUZE V., and G. TRAN. 2015. *Rice bran and other rice by-products*. Feedipedia, a programme by INRA, CIRAD, AFZ and FAO. Retrieved February 2016 from <http://feedipedia.org/node/750>.
- HARRIS, L. E.** Undated. Chapter 8. Feedstuffs – FAO. FAO Corporate Documentary Repository. Retrieved February 2016 from www.fao.org/docrep/x5738e/x5738e09.htm
- HEINRITZ, S.** 2011. Ensiling suitability of high protein tropical forages and their nutritional value for feeding pigs. Diploma thesis on Agribiology. University of Hohenheim, Stuttgart, Germany.

- LY, J., H. PHEAP, K. SAETH and P. SAMKOL.**2002. The effect of DL-methionine supplementation on digestibility and performance traits of growing pigs fed broken rice and water spinach (*Ipomoea aquatica*). Livestock Research for Rural Development.University of Tropical Agriculture Foundation.ChamcarDaung, Phnom Penh, Cambodia.
- MALAVANH, C. and T. R. PRESTON.**2006. Intake and digestibility by pigs fed different levels of sweet potato leaves and water spinach as supplements to a mixture of rice bran and cassava root meal.<http://www.lrrd.org/lrrd18/6/mala18086.htm>. Cited in CHIV PHINY, B. OGLE, T. R. PRESTON, and K. BORIN. 2008. Growth performance of pigs fed water spinach or water spinach mixed with mulberry leaves, as protein sources in basal diets of cassava root meal plus rice bran or sugar palm syrup plus broken rice. Centre for Livestock and Agriculture Development. Tosoly UTA – Colombia.
- MALAVANH, C., T. R. PRESTON and B. OGLE.** 2007. Effect of replacing soybean meal by a mixture of taro leaf silage and water spinach on reproduction and piglet performance in Mong Cai gilts. MEKARN Regional Conference: Matching Livestock Systems with Available Resources. Retrieved July 31, 2016 from <http://www.lrrd.org/lrrd20/supplement/mala2.htm>.
- MORAN, J.**2005. Tropical dairy farming: feeding management for smallholder dairy farmers in the humid tropics: Chapter 9 – Making quality silage. Landlinks Press. pp. 83-96.
- NADEAU, E. M. G. and S. K. BARNHART.** 2008. The Ensiling Process and Additives. University Extension, Iowa State University.
- NAMOCO, R. P. and K. C. P. GICAN.** 2012. Alternative feed rations for grower stage backyard swine. Mindanao Journal of Science and Technology Vol. 0: 93-106. Mindanao University of Science and Technology.
- OUDE ELFERINK, S. J. W. H., F. DRIEHUIS, J. C. GOTTSCHAL, and S.F. SPOELSTRA.** 2000. Silage fermentation processes and their manipulation. In: Silage Making in the Tropics with Particular Emphasis on Smallholders. FAO Plant Production and Protection Paper 161. Proceedings of the FAO Electronic Conference on Tropical Silage, 1 September to 15 December 1999. Rome, Italy.Cited in HEINRITZ, S. 2011.Ensiling suitability of high protein tropical forages and their nutritional value for feeding pigs.Diploma thesis on Agribiology.University of Hohenheim, Stuttgart, Germany.
- PALADA, M. C. and S. M. A. CROSSMAN.** 1999. Evaluation of Tropical leaf vegetables in the Virgin Islands. In: Perspectives on New Crops and New Uses

(J.Janick, editor). Cited in SUHEANG, S. Utilization of sugar cane stalks and water spinach for fattening pigs and their residues as substrate for the earth worms.Center for Livestock and Agriculture Development.CelAgrid – UTA, Cambodia.

PERKINS, J. 2002. What should I do? Research for people, not pigs.Institute of Land and Food Resources, University of Melbourne, Victoria, 3010, Australia.Cited in ACIAR Working Paper No. 53: Priorities for pig research in Southeast Asia and the Pacific.Australian Centre for International Agricultural Research Canberra.p. 14.

PHILSAN, 2010. Feed Reference Standards. 4th edition.University of the Philippines Los Baños, College, Laguna. Philippine Society of Animal Nutritionists, Animal and Dairy Sciences Cluster. pp. 1-122; 221-250.

SUHEANG, S. 2003.Utilization of sugar cane stalks and water spinach for fattening pigs and their residues as substrate for the earth worms.Center for Livestock and Agriculture Development.CelAgrid – UTA, Cambodia.

TAYSAYAVONG, L. and T. R. PRESTON.2010. Effect of rice distiller’s by-product on growth performance and digestibility of Moo Laat and Mong Cai pigs fed rice bran and water spinach. Champasack University.Champasack Province, Lao PDR.

TOMITA Y., K. HAYASHI, and T. HASHIZUME.1985. Palatability of pigs to sweet potato-silage and digestion trial by them. Bulletin of the Faculty of Agriculture, Kagoshima University No. 35:75–80. Cited in HEUZE V., G. TRAN, and P. HASSOUN. 2015. *Sweet potato (Ipomoea batatas) forage*. Feedipedia, a programme by INRA, CIRAD, AFZ and FAO. Retrieved May 2017 from <http://feedipedia.org/node/551>.

TIWARI, N. C. and V. CHANDRA. 1985. water spinach its varieties and cultivation. National Botanical Research Institute. India Horticulture.Cited in SUHEANG, S. 2003.Utilization of sugar cane stalks and water spinach for fattening pigs and their residues as substrate for the earth worms.Center for Livestock and Agriculture Development.CelAgrid – UTA, Cambodia.

VANZI S, J., 1997. Kangkong, “anyone”.Filipino Today.July-August.www.intergon.com/-fildtoday/aug97/timplat.htm. Cited in SUHEANG, S. 2003.Utilization of sugar cane stalks and water spinach for fattening pigs and their residues as substrate for the earth worms.Center for Livestock and Agriculture Development.CelAgrid – UTA, Cambodia.

- VILLAR, E. C., M.O. MALEON and D.T. FACUNDO.** 2002. The swine industry in the Philippines: A focus on smallholders. Cited in ACIAR Working Paper No. 53: Priorities for pig research in Southeast Asia and the Pacific. Australian Centre for International Agricultural Research Canberra. pp. 46-56.
- WOOLFORD, M.K.** 1984. The Microbiology of Silage, Chapter 2 In: The Silage Fermentation. Marcel Dekker Inc., New York, NY, USA. 23-59. Cited in **HEINRITZ, S.** 2011. Ensiling suitability of high protein tropical forages and their nutritional value for feeding pigs. Diploma thesis on Agribiology. University of Hohenheim, Stuttgart, Germany.