RESPONSES OF DIFFERENT PURPLE NUTSEDGE (*Cyperus rotundus* L.) ECOTYPES TO EARLY AND LATE FLOODING

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ACCEPTANCE SHEET

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BIOGRAPHICAL SKETCH

The author was born on 3rd day of February, 1999 at Mariveles Bataan. They moved to Sta. Rosa Nueva Ecija when he was 6 years old until he finished secondary education. He is currently living at Brgy. Maligaya, Science City of Muñoz, Nueva Ecija and finishing his study at Central Luzon State University. He is the youngest son of Jocelyn and Juanito Bruno. Their family depends on the salary of his sister who is currently working and studying abroad as well as farming of his father.

He finished his primary education at La fuente Elementary School with honors and accomplished his secondary education at Sto. Rosario National High School, Sto. Rosario, Sta Rosa Nueva Ecija. With his dedication, he graduated class salutatorian.

After he graduated in year 2014 to 2015, he decided to take entrance exam at Central Luzon State University and he passed. However, due to financial struggle, it hindered him to pursue his study. But because of those opportunities that were opened to him like having a scholarships he was able to go through it.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF APPENDIX TABLES

LIST OF FIGURES

LIST OF APPENDIX FIGURES

ABSTRACT

BRUNO, JAYVEE S., Department of Crop Protection, College of Agriculture, Central Luzon State University, Science City of Muñoz, Nueva Ecija, Philippines, **September 2019, RESPONSES OF DIFFERENT PURPLE NUTSEDGE (*Cyperus rotundus* L.) ECOTYPES TO EARLY AND LATE FLOODING**

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This study aimed to determine the responses of different purple nutsedge (*Cyperus rotundus* L.) ecotypes to early and late flooding. The experiment was laid out two-way factorial in Randomized Complete Block Design (RCBD). In this study, two factors were involved such as Factor A (Flooding) and Factor B (Ecotypes). Two experiments were conducted simultaneously such as early and late flooding. Different ecotypes of *Cyperus rotundus* L. were collected in upland and lowland rice field.

Controls were flooded throughout and maintained saturated, represented by A1 and A5, respectively. Early and late flooding within 7, 14 and 21 DAP were labeled as A2, A3 and A4, respectively. Height and number of shoots were measured regularly within 50 days of experiment.

Results revealed that keeping the pre-germinated tubers to flooding within 50 DAP severely reduced the height and production of shoots in both upland and lowland ecotype. On the contrary, maintaining it under saturated condition allowed the growth of shoots. Furthermore, early flooding minimized the growth of these ecotypes. However, late flooding allowed early growth and establishment of *Cyperus rotundus* L. and therefore produced more shoots and tubers.

Keywords: *Cyperus rotundus* L.; flooding; ecotypes

LITERATURE CITED

Azmi, M., Chin, D.V., Vongsaroj, P., & Johnson, D. E. (2005). Emerging issues in weed management of direct-seeded rice in Malaysia, Vietnam, and Thailand. In: Toriyama, K., Heong, K.L., Hardy, B. (Eds.), Rice Is Life: Scientific Perspectives for the 21st Century. International Rice Research Institute, and Tsukuba (Japan): Japan International Research Center for Agricultural Sciences, Los Ba–nos (Philippines), pp. 196–198. Proceedings of the World Rice Research Conference held in Tokyo and Tsukuba, Japan, 4–7 November 2004.

Akobundu, I.O. & Agyakwa, C.W. (1998). A handbook of West African weeds. *International Institute of Tropical Agriculture*, Ibadan, p 438

Baltazar, A. M., & De Datta, S. K. (1992). *Weed management in rice*. Weed Abstr. 41, 495–507.

Baltazar, A. M., Martin, E. C., Casimero, M. C., Bariuan, F. V., Obien, S. R., & DeDatta S.K. (1997). Characterization of purple nutsedge in rainfed rice-onion systems. Proc.Asian-Pacific Weed Sci. Soc. Conference 16,326–329.

Baltazar, A.M, Martin, E.C, Casimero, M.C, Bariuan, F.V, Obien S.V, & De Datta, S.K. (1999). Major weeds and their dominance patterns in rainfed rice-onion cropping system. *Philippine Agricultural Scientist* 82: 166–177.

Baltazar A.M, Johnson DE, Ismail A, Janiya JD, Bariuan FV, Pena JT, Villalobos MC, & Merca FE. (2006). Control of sedges in rice: wetland purple nutsedge. In: Kim KU, Labrada R, eds. Management of sedge weeds in rice. Proceedings of the Workshop on Management of Sedge Weeds in Rice, Ho Chi Minh City, Vietnam. 6 November 2005. Daegu: Kyungpook National University, Korea, 43–52.

Bangarwa, SK, Norsworthy, JK, Jha, P, & Malik, M. (2008). Purple nutsedge (*Cyperus rotundus*) management in an organic production system. *Weed Science* 56:606–613.

Bendixen, L. D., & Stoube, E. W. (1977). Yellow and purple nutsedge: Two weed species of worldwide significance. *Weeds Today* 9: 9-15.

Bendixen L.E., & Nandihalli, U.B. (1987). Worldwide distribution of purple and yellow nutsedge (*C. rotundus* L.and *C. esculentus*). *Weed Technology* 1:61–65.

Benz, BR, Rhode, JM, & Cruzan, MB. (2007). Aerenchyma development and elevated alcohol dehydrogenase activity as alternative responses to hypoxic soils in the Piriqueta caroliniana complex. *American Journal of Botany* 94:542–550.

Brosnan JT, & Defrank J (2008). Purple nutsedge control in turf and ornamentals. Cooperative Extension Service, College of Tropical Agriculture and Human Resources, University of Hawaii, Mano.

Bryson, C. T., & DeFelice, M. S. (2009). Weeds of the South. University of Georgia Press, Athens, GA.

Casimero, M. C., Baltazar, A. M., Manuel J.S., Obien S.R. & DeDatta S.K. (1999). Morphologic and genetic variations in upland and lowland ecotypes of purple nutsedge (*Cyperus rotundus* L.) in rainfed rice-onion systems. *Proc.Asian-Pacific Weed Sci. Soc. Conference* 17:134–139.

Cerrizuela, E. (1965). Effects of weeds in sugar cane fields (Argentina). *Revista industrial y agricola de Tucuman* 43:1-12.

Cirujeda A. Anzalone A, Aibar J, Moreno M.M. & Zaragoza C. (2012). Purple nutsedge (*Cyperus rotundus* L.) control with paper mulch in processing tomato. *Crop Prot* 39:66–71.

Chauhan, B. S. (2012). Weed ecology and weed management strategies for dry-seeded rice in Asia. *Weed Technol*. 26:1–13.

Dor E, Hershenhorn J. (2013). Effect of low temperature on purple nutsedge (*Cyperus rotundus* L.) reproductive biology. *Weed Sci* 61:239–243.

Drew, M. C. (1997). Oxygen deficiency and root metabolism: injury and acclimation under hypoxia and anoxia. *Annual Review of Plant Physiology and Molecular Biology* 48: 223–250.

El-Sheikh, MA (2005). Plant succession on abandoned fields after 25 years of shifting cultivation in Assiut, Egypt. *J Arid Environ* 61:461–481.

FAO (Food and Agriculture Organization), (2009). FAOSTAT Database. FAO, Rome. www. faostat.fao.org (accessed June 2010).

Fuentes, R. G., Fuentes, A. M., Baltazar, F. E., Merca, A. M., Ismail, D. E., & Johnson. (2010). Morphological and physiological responses of lowland purple nutsedge (*Cyperus rotundus* L.) to flooding.

Fukao, T., & Bailey-Serres, J. (2004). Plant responses to anoxia—is survival a balancing act?. *Trends in Plant Science* 9: 449–456.

Hauser, E. W. (1962). Development of purple nutsedge under field conditions. *Weeds* 10:315-321.

Ho, N. K., & Itoh, K. (1991). Changes in weed flora and their distribution in the Muda area. In: *Paper Presented at the 8th MADA/TARC Quarterly Meeting, 3 November 1991, Alor Setar, Malaysia.*

Holm, L. G., Plucknett, D. L., Pancho, J. V., & Herberger, J. I. (1977). The world's worst weeds. *Distribution and Biology*. Honolulu: University Press Hawaii (pp.609).

Horowitz M. (1992). Mechanisms of establishment and spreading of *Cyperus rotundus* - the worst weed of warm regions. Proceedings of the First International Weed Control Congress, Melbourne, (pp.94).

Islam, Md. N., Baltazar, A. M., Datta, S. K. D., & Karim, A. N. M. R. (2009). Management of Purple Nutsedge (*Cyperus rotundus* L.) Tuber populations in rice-onion cropping systems. *PHILIPP AGRIC SCIENTIST*. 941(4):407-418

Islam, Md. N., Baltazar, A.M., Manuel, J.S., Martin E.C., Ramos, J.M., De Datta S.K., & Karim A.M.N.R. (2005). Tuber production, population dynamics and management of purple nutsedge in a rice– onion rotation system. In: *Proceedings of the 20th Asian-Pacific Weed Science Society Conference, Ho Chi Minh City, Vietnam*. 7–11 November 2005. Ho Chi Minh City, Vietnam: Agricultural Publishing House, (pp.541–549).

Ivens GW. (1989). Eastern Africa weeds control. *Oxford University Press*, Nairobi, p 17

Janiya, J. D. (2002). Yield losses, major weed species, and suggested management systems in selected major crops: rice. In: Weed management in major crops in the Philippines. Los Baños, Laguna, Philippines: *Weed Science Society of the Philippines*, (pp.17–37).

Karim, R. S. M., Man, A. B., & Sahid, I. B. (2004). Weed problems and their management in rice fields of Malaysia: an overview. *Weed Biology Management* 4:177–186.

Keeley, P. E. (1987). Interference and interaction of purple nutsedge and yellow nutsedges (*Cyperus rotundus* L. and *C. esculentus*) with crops. *Weed Technology*. 1:74-81

Khalid, S, Siddiqui, SU. (2014). Weeds of Pakistan: Cyperaceae. *Pakistan Journal Weed Science Research* 20:233–263.

Komai, K., Iwamura, J.C., Kiatsoonthorn, V., & Ueki, K. Geographical variation of *Cyperus rotundus* L. and ecological properties. Proceedings of 9th Asian-Pacific

Weed Science Society Conference; November 28–December 2, 1983; Manila. Manila, Philippines: *Asian-Pacific Weed Science Society*,.(pp. 66–70).

Kumar, V., Bellinder, R. R., Gupta, R. K., Malik, R. K., & Brainard, D. C. (2008). Role of herbicide-resistant rice in promoting resource conservation technologies in rice-wheat cropping systems of India: a review. *Crop Protection* 21:290–301.

Kumar, V., & Ladha, J. K. (2011). Direct seeding of rice: recent developments and future needs. *Advance Agronomy* 111: 297–413.

Lati, R.N., Filin, S. & Eizenberg, H. (2011). Temperature- and radiation-based models for predicting spatial growth of purple nutsedge (*Cyperus rotundus*). Weed Science, 59(4): 476-482

Matloob, A, Khaliq, A, Farooq, M. et al., (2010). Quantification of allelopathic potential of different crop residues for the purple nutsedge suppression. *Pakistan Journal Weed Science Research* 16:1–12

Mohanty, H., Mallik, S., & Grover, A. (2000). Prospects of improving flooding tolerance in lowland rice varieties by conventional breeding and genetic engineering. *Current Science* 78:131–140.

Morales-Payan, J, P., Santos, B, M., & Bewick, T. A. (1996). Purple nutsedge (*Cyperus rotundus* L.) interference on lettuce under different nitrogen levels. *Proc.South. Weed Science Society*. 49: 201

Morales-Payan, J, P., Santos, B. M., Stall, W. M., & Bewick, T. A. (1998). Interference of purple nutsedge (*Cyperus rotundus*) population densities on bell pepper (*Capsicum annuum*) yield as influenced by nitrogen. *Weed Technology*. 12:230-234.

Mortimer, A. M., & Hill, J. E. (1999). Weed species shifts in response to broad-spectrum herbicides in sub-tropical and tropical crops. In: "*Proceedings of 1999 British Crop Protection Conference: Weeds*". 15–18 November, Brighton, UK, (pp. 425–436).

Nishimoto, R.K. (2001). Purple nutsedge tuber sprouting. *Weed Biology Management* 1:203–208

Okafor, L. I., & De. Datta, S. K. (1976). Competition between upland rice and purple nutsedge for nitrogen,moisture and light. *Weed Science* 24,43-46.

Okoli, C.A.N., Shilling, D.G, Smith R.S., & Bewick, T.A. (1997) Genetic diversity in purple nutsedge (*Cyperus rotundus* L.) and yellow nutsedge (*Cyperus esculentus* L.). *Biological Control* 8:111–118

Pablico, P. P., & Moody, K. (1985). A wet season lowland rice (Oryza sativa) weed survey in Central and Southern Luzon, *Philippine Journal of Weed Science* 12:39-49.

Parsons WT, & Cuthbertson, EG (2001) Noxious weeds of Australia. CSIRO Publishing, Collingwood

Peña-Fronteras, J. T., Villalobos, M. C., Baltazar, A. M., Merca, F. E., Ismail, A. M., & Johnson, D. E. Adaptation to flooding in upland and lowland ecotypes of *Cyperus rotundus*, a troublesome sedge weed of rice: tuber morphology and carbohydrate metabolism. *Annuals of Botany*, 103:295–302.

Pereira, W. et al. (1987) "Herbicide Action on Purple and Yellow Nutsedge (*Cyperus rotundus* and *C. esculentus*" *Weed Technology* 1:92-98.

Philippine Statistic Authority. (2018). Seasonally adjusted rice production and prices: October to December 2017.

Peerzada, AM, Ali HH, Naeem, M, Latif, M, Bukhari AH, & Tanveer, A. (2015). *Cyperus rotundus* L.: traditional uses, phytochemistry, and pharmacological activities. *J Ethnopharmacology* 174:540–560.

Ranade, S. B., & Burns, W. (1925). The eradication of *Cyperus rotundus* L. Mem. India *Dep. Agric. Bot. Ser.* 13: 99-192.

Rao, A. N., Johnson, D. E., Sivaprasad, B., Ladha, J. K., & Mortimer, A. M. (2007). Weed management in direct seeded rice. *Advance Agronomy* 93:153–255.

Ravinsankar, D., Chinnamuthu, C.R., & Srimanthi, D. (2017). Assessment of tuber viability and sprouting behavoir of purple nutsedge (*Cyperus rotundus*)- A Prelude Study for Control of World Worst weed, *International Journal of Current Microbiology and Applied Sciences* 6(9):886-895.

Santos, B.M., Morales-Payan, J.P., Stall, W.M., Bewick, T.A., & Shilling, D.G. (1997) Effect of shading on the growth of nutsedges (*Cyperus* spp.). *Weed* Science 45:670–673.

Takim, F. O. & Uddin II, R. O. Effect of weed removal on insect populations and yield of cowpea [*Vigna unguiculata* (L.) Walp]. *Australian Journal of Agricultural Engineering* 1(5):194-199.

Tomita, S., Nawata, E., Kono, Y., Inamura, T., Nagata, Y., Noichana, C., & Sributta, A., (2003). Impact of direct dry seeding on rainfed paddy vegetation in north-east Thailand. *Weed Biology Management* 3:68–76.

Santos, B. M., Morales-Payan, J. P., & Bewick, T. A. (1996). Purple nutsedge (*Cyperus rotundus*) interference on raddish under different nitrogen leyels. *Weed Science Society Am*erica Abstract 36: 69.

Singh, S., Singh, G., Singh, V. P., & Singh, A. P. (2005). Effect of establishment methods and weed management practices on weeds and rice in rice-wheat cropping system. *Weed Science*. 37:51–57.

Singh, S., Chhokar, R. S., Gopal, R., Ladha, J. K., Gupta, R. K., Kumar, V., & Singh, M. (2009). Integrated weed management: a key to success for direct-seeded rice in the Indo-Gangetic Plains. In: Ladha, J.K., Singh, Y., Erenstein, O., Hardy, B. (Eds.), Integrated Crop and Resource Management in the Rice-wheat System of South Asia. International Rice Research Institute, Los Baños, Philippines, (pp. 261–278).

Srivastava, R.K. & Singh, A, Shukla, S.V. (2013). Chemical investigation and pharmaceutical action of Cyperus rotundus-a review. Biology Active Production Nat 3:166–172.

Stoller, E.W., & Sweet, R.D. (1987) Biology and life cycle of purple and yellow nutsedges (C. *rotundus* and C. *esculentus*). *Weed Technology* 1:66–73.

Terry, P.J., & Magambo, M.J.S. (1972). Herbicide screening trial against *Cyperus rotundus*. Miscellaneous Report East African Community. *Tropical Pest Research Institute* 803:1–10.

Wang, G, Mcgiffen, M.E., Ogbuchiekwe E.J., & Butler, L. (2009). Economic return of purple and yellow nutsedge management in vegetable production of Southern California. *Crop Protection* 28:319–326

William, R. D., & Warren, G. F. (1975). Competition between purple nutsedge and vegetables. *Weed Science* 23: 317-323

Wills, G. D. (1987). Description of purple and yellow nutsedge (*Cyperus rotundus and C. esculentus*). *Weed Technology* 1:2-9.

Wills, G.D. (1998). Comparison of purple nutsedge (*Cyperus rotundus*) from around the world. *Weed Technology* 12:491–503

Yamasue Y. (2001). Strategy of *Echinochloa oryzicola* Vasing for survival in flooded rice. *Weed Biology and Management* 1(1):28 - 36