

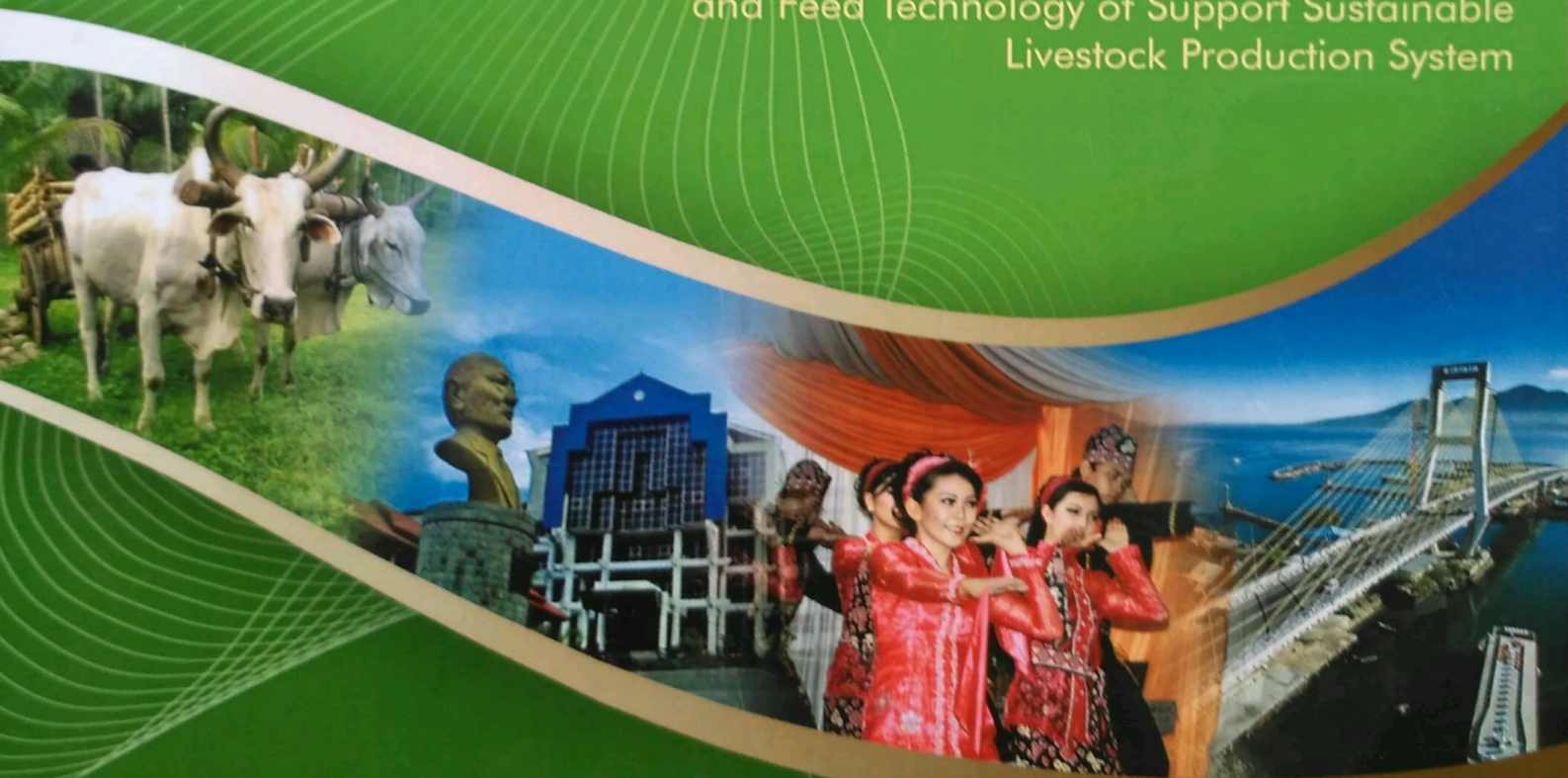


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PROCEEDING

4th INTERNATIONAL SEMINAR OF ANIMAL NUTRITION & FEED SCIENCE (ISAINI 2015)

Theme:
Recent Advance in Animal Nutrition
and Feed Technology of Support Sustainable
Livestock Production System



SEPTEMBER 8TH-9TH, 2015 - SINTESA PENINSULA HOTEL
MANADO, NORTH SULAWESI - INDONESIA

PROCEEDING
4th International Seminar of AINI (ISAINI) 2015
*“Recent Advance in Animal Nutrition and Feed Technology to Support Sustainable
Livestock Production System”.*
Faculty of Animal Husbandry, Sam Ratulangi University, Manado North Sulawesi
Pennisula Hotel, Manado 8-9 September 2015

Editors:

Dr. Ir. Osfar Sjojfan, MSc

Dr. Anuraga Djayanegara, SPt., MSc

Wahyu Darsono, SPt., MSi

Ir. Jola JMR Londok, MSi

Ir. Youdhie HS Kowel, MSi

Mursye N Regar, SPt., MSi

Faculty of Animal Husbandry Sam Ratulangi University
Manado, Sulawesi Utara, Indonesia

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WELCOMING SPEECH PRESIDENT OF AINI

Assalamu ‘alaikum Wr. Wb.,

His Excellency Governor of North Sulawesi

The honorable Rector of The University of Sam Ratulangi,

The Dean of Faculty of Animal Science, University of Sam Ratulangi,

Distinguish guests, participants, ladies and gentlemen,

First of all, on behalf of the Indonesian Animal Nutritionist and Feed Scientist Association (AINI), I would like to extend our warmest welcome, and indeed it is a great pleasure to see you all in this room, participating in the 4th *International Seminar and 10th Biennial Meeting of AINI* held in Manado North Sulawesi. At this time being, AINI is almost 20 years old since its first establishment in 1996 at Bogor. AINI was created with the objectives to gather all of the animal nutrition and feed scientists in Indonesia permitting to the exchange of knowledge and experiences under spirit of brotherhood, to stimulate the advancement of science and technology in nutrition and feed science, thus benefiting to the competitiveness of livestock agribusiness.

As the president of AINI since 2007, I and all of board committee member have been trying to do the best we could do for AINI being better well known at the national and International level. This International seminar is conducted with the objective also to serve better the AINI member on new research finding and provide the forum of meeting and exchange among scientists. We have successfully conducts regular international seminar every two years, thanks to the efforts of all AINI member have been dedicated to. The first international conference was held in UNSOED Purwokerto (2009), the second was held in UNPAD Bandung (2011), the third was held in UNAND Padang West Sumatera (2013), and the forth International seminar is held here at UNSRAT Manado North Sulawesi (2015).

Distinguish guests, participants, ladies and gentlemen,

The recommendation made by the 3rd International Seminar of AINI (ISAINI), held in Padang, was to recommend the Faculty of Animal Husbandry, Sam Ratulangi University, Manado, to be the host for the 4th ISAINI 2015. The Theme of this International Seminar is “**Recent Advance in Animal Nutrition and Feed Technology to Support Sustainable Livestock Production System**”. Sustainable livestock production system is now become the hot issue. The huge demand of animal products such as meat egg and milk to cover the growing population in the world should be handled with care without destroying the environment. Environment and its quality are becoming more and more degrading and reducing. Indeed, the effects of global warming could be feeling now with for example the longer dry session period that might reduce even destroy agricultural products and its productivity. In the case of Indonesia, it is projected that the demand of animal products will increased significantly while the national production is not sufficient enough to cover the demand. High price of red meat

and fluctuation of poultry meat price recently indicate the phenomenon of the imbalance supply-demand. We, as the scientist especially in animal nutrition and feed science, should engage and do our best to support the government policy in fulfilling the food of animal products, quantitative and qualitatively. In this regards, role of nutrition and also Nutritionist and Feed Scientist are very important, since the feed cost is the major component cost of livestock production. During this seminar, recent advance in animal nutrition and feed science will be shared and discussed to support the sustainable livestock production system.

Distinguish guests, participants, ladies and gentlemen,

On behalf of the AINI, at this opportunity, I should express my sincere thanks to the Dean of the Faculty of Animal Science University of Sam Ratulangi, the organizing committee, sponsors, and all party that cannot be listed since we are deeply in debt to all of your effort and sacrifice to the success of this seminar. Our sincere thanks and deepest gratitude must go to the invited speakers : Prof. Dr. Ir. Muladno, MSA (Director General of Livestock and Animal Health, Ministries of Agriculture of The Republic Indonesia); Prof. Abdul Razak Bin Alimon, PhD from Putra University, Malaysia; Prof. Cheol-Heui Yun, PhD from Seoul National University, South Korea; Dr. Ir. Osfar Sofjan, MSc from Brawijaya University Malang; Prof. Dr. Ir. David Arnold Kaligis, DEA from Sam Ratulangi University, Manado and Felipe Sanchez Fernandez from Throuw Nutrition. We are in debt to your effort and your participation in this event. Your views will enlighten and inspire all of the participants on how to develop sustainable livestock production system through the animal nutrition and feed science intervention.

Distinguish guests, participants, ladies and gentlemen,

I hope you will have the fruitful meeting and gaining many new ideas and perspectives to be developed in the future. I do hope also, we will see you again in the 5th International seminar and 11th Biannual meeting (ISAINI 2017) in which the host will be determined further by the board of committee meeting during this event. Finally and surely, please enjoy your stay with North Sulawesi culture and nature, tradition and hospitality, in addition to your scientific activities.

Thank you

Wassalamu ‘alaikum Wr. Wb.

Manado, September 8th, 2015
President of AINI

Prof. Dr. Ir. Ali Agus, DAA, DEA

WELCOMING SPEECH

ORGINIZING COMMITTEE

Dear all of the scientists, delegates, participants, ladies and gentlemen,

As the host of the AINI International Seminar, we do impress, thankful, and present a high appreciation for your participation in joining the AINI International Seminar in Manado, Indonesia, the land of waving coconut trees. We can see the very great enthusiasm of all the scientists to solve livestock problems as well as to share valuable information and knowledge for human prosperity all over the world.

A large numbers of representatives are participating in this conference, which indicates that the interest in the field of animal science is continuously increasing among member countries. We have invited some Plenary Speakers and Invited Papers who are qualified as scientists and bureaucrats in animal nutrition and feed science field to share their valuable information and knowledge. Other participants can deliver their precious research through oral and poster presentations. This Seminar is also paralleled to Indonesian Association of Animal Nutritionist and Feed Scientists (AINI) Congress held by National Board.

The theme of the AINI International Seminar is “*Recent Advance in Animal Nutrition and Feed Technology to Support Sustainable Livestock Production System*”. We believe that animal production in Indonesia has become important and strategic sector to provide high quality food, opening up job opportunities, as well as improving farmer’s welfare. Indonesian Association of Animal Nutritionist and Feed Scientists, therefore, have to support this growing interest by providing more appropriate, recent, and relevant technologies to supportsustainablelivestockproductionsystem to produce more animal protein food.

On behalf of AINI International Seminar Committee and all associates, we wish all of the participants having a great achievement of success and fulfill the expectation as well as enjoying the interaction with all scientists’ participants the Seminar.

High appreciation we may acknowledge to all of sectors, especially for Her excellency Rector of Sam Ratulangi University, who have concerned to facilitate the Seminar and Congress site host. Special thanks to the Steering Committee, Scientific Committee, Reviewers and Editorial Boards for their great contribution to make the Seminar and Congress successfully organized.

To you, you’re Excellency, invited guests and delegates, thank you for choosing to cometo this Seminar and Congress and to Manado, Indonesia. We hope the arrangements we have put in place meet with your requirements. We wish you fruitful deliberations and an intellectually and socially rewarding stay in Manado.

We are looking forward to meeting you all in the future congress to continue.

Terimakasih (Thank you)

Chairman of the 4th AINI International Seminar

Prof. Dr. Ir. BernatTulung, DEA

KEYNOTE SPEAKERS



Prof. Dr. Ir. Muladno, MSA

*Director General of Livestock and Animal Health,
Ministries of Agriculture of the Republic Indonesia*

Professor Muladno was born in Kediri, East Java on 24 August 1961. He was educated for undergraduate education at Faculty of Animal Husbandry, Gadjah Mada University. His master of science in University of New England, Armidale, Australia in the area animal breeding and genetics. He completed his Ph. D at University of Sydney, Australia in molecular genetics. He pursued his post – doctoral at science and technology agency of Japan at National Institute of Animal Industry, Tsukuba Japan. Then from society for agricultural, forestry and fisheries (STAFF) Institute, Tsukuba, Japan and from Japan Society for Promotion of Science (JSPS) at Nagoya University, Japan and from Indonesian-Australia Programme of specialized training on Intellectual Property Rights at University of Technology, Sydney, Australia.



Prof. Abdul Razak Bin Alimon, Ph.D

Professor, Putra University, Malaysia

Professor Alimon was born on January 25, 1949. He was educated for his bachelor of science in the area of nutrition and physiology, postgraduate diploma of science and master of science in agriculture at University of New England, Australia. He completed his Ph. D at University of Reading in area of animal nutrition.



Prof. Cheol-Heui Yun, PhD

Professor, Seoul National University, Republic of Korea

Professor Cheol-Heui YUN grew up in Gwang-ju, a southwest of Republic of Korea. He was educated at the Chon am National University for B.Sc. and the Seoul National University for his M.Sc. in the area of Animal Nutrition. Professor Yun completed his Ph.D. at the University of Saskatchewan, Canada in the area of immune modulation and mucosal immunology. Then, he pursued his professional career at leading research institutes in different region of the world including International Vaccine Institute (IVI, Korea), United States Department of Agriculture (USDA, USA), National Institutes of Health (NIH, USA) and Gothenburg University (Sweden) where he undertook research related to vaccinology, infection biology and cellular immunity. Currently, he serves as editor of a number of societies including World Journal of Immunology, Frontiers in Molecular Innate Immunity, Journal of Biomaterials and Tissue Engineering, Scientific World Journal, Journal of Microbiology, and Science Editing. He was selected and serves as a vice Editor-in-Chief at Asian-Australasian Journal of Animal Sciences. Currently, he is the president of Korean Dendritic Cell Academic Society. Recently, his interest has focused on the action mechanism of vaccine and vaccine adjuvants against a various (mucosal) diseases in mouse as a model system and ultimately domestic animals.



Dr. Ir. Osfar Sjojfan, MSc

Faculty of Animal Husbandry, Brawijaya University, Malang, Indonesia

Dr. Osfar was educated for B.Sc in Animal Husbandry at Padjajaran University and M.Sc in Poultry Feed at Wageningen Agricultural University, The Netherlands. He pursued his doctoral in Animal Science at University of Padjajaran, Bandung. His interest in Animal Nutrition.



Prof. Dr. Ir. David Arnold Kaligis, DEA

Professor, Faculty of Animal Husbandry, Sam Ratulangi University, Manado, Indonesia

Professor Kaligis was born in Semarang on December 9, 1948. He was educated at Faculty of Animal Husbandry, Sam Ratulangi University (Undergraduate), Universite Science et Technique du Languedoc Montpellier, France for his master and doctor in agronomi option zootechnique. His interest in forages sciences.



Felipe Sanchez Fernandez

*Trouw Nutrition Application and Solution Center
Poultry Specialist and Technology Transfer*

Veterinarian bachelor marketing and sales management master degree. More than 20 years working in poultry production as Poultry Product Manager, in Cargill Animal Nutrition and Nutreco compound feed business, with direct responsibilities on poultry nutrition, technical consultancy services and business development manager. In 2012, he was appointed to Trouw Nutrition Application and Solution Centre when he lead R and D projects and transfer innovations and technology to Nutreco operative companies.

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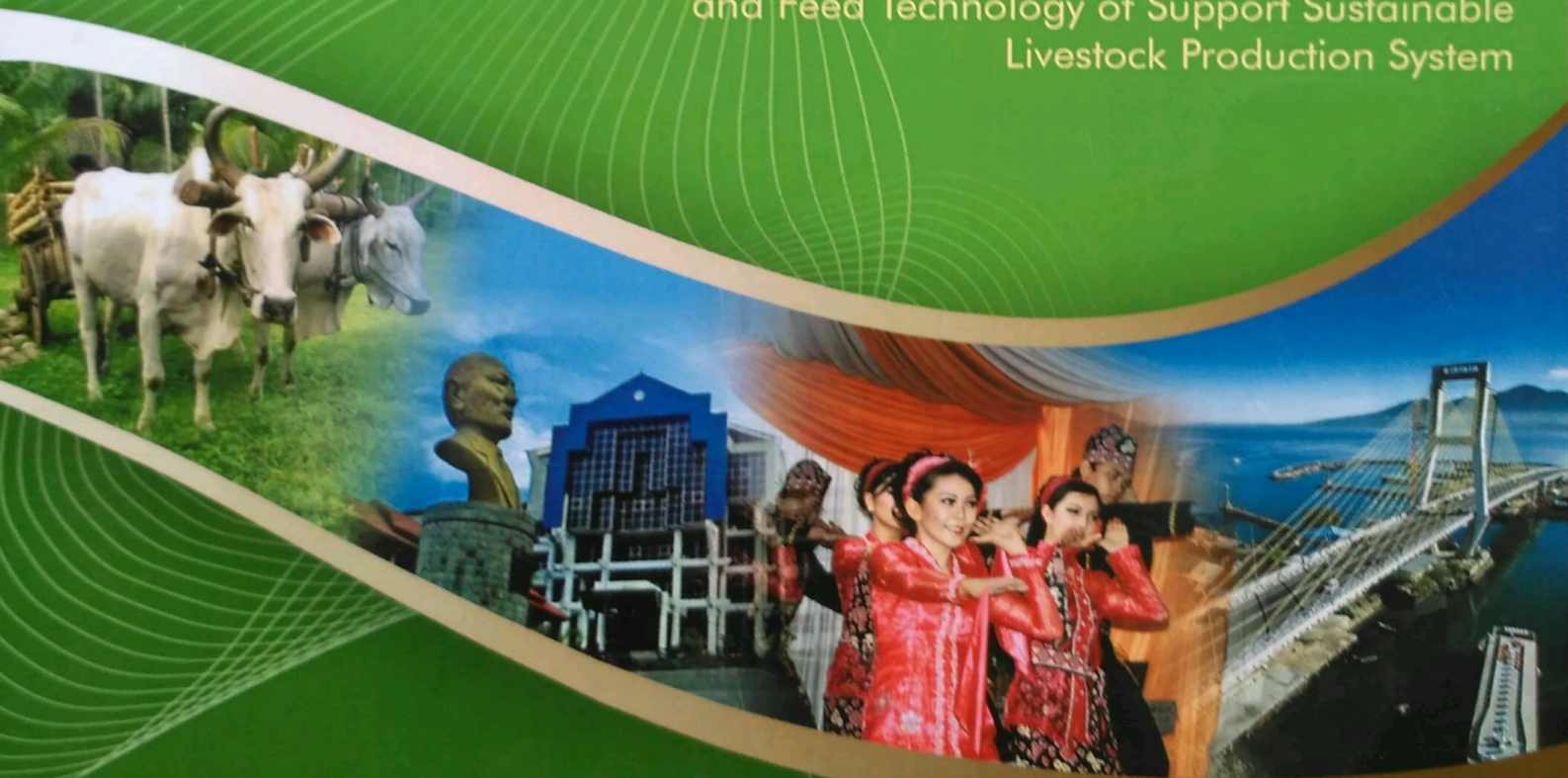


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THE EFFECTIVENESS OF PADDY FIELD MUD ON CULTIVATION OF *AZOLLA PINNATA* AS A HIGH PROTEIN FORAGE

Prihantoro I¹, Adiyanti L², Setiana MA³, Karti PDMH⁴

1,2,3,4Department of Nutrition and Feed Technology, Faculty of Animal Science, Bogor
Agricultural University, Jl. Agatis Kampus IPB Dramaga Bogor 16680 –
Indonesia Corresponding email: iprihantoro@yahoo.com

ABSTRACT

Aquatic macrophytes, such as *Azolla pinnata* has a wide range of adaptation in growth and fast yield time. This plant has high nitrogen fixation ability and potency as high protein forage. The aim of this research was to measure production potency and protein content on several media. This research was designed using factorial completely randomized design with two factors. Factor A was paddy field mud 10% and factor B was media (control, *hoagland*, and *hyponex* 0.1%). The measured parameters were dissolved N absorption, doubling time, cover area, biomass production, and protein content. Data were analyzed using ANOVA and the results showed that *Azolla pinnata* has high dissolved N absorption ($\geq 97.51\%$). Additional of paddy field mud and kinds of media treatments significantly shortened doubling time, cover area, biomass production, and protein content compared with control (without paddy field mud) ($p < 0.05$).

Keywords : Aquatic macrophytes, *Azolla pinnata*, high protein forage

INTRODUCTION

Forages are the main sources of feed for ruminant that determine livestock performance and productivity. Forage production is high at rainy season and low at dry season with relatively lower forage quality. The land use status for pasture was limited because of the other transformation. So that, it is necessary to improve aquatic plants potency as a potential aquatic area utilization in Indonesia.

Azolla pinnata is an aquatic fern which is potential as an alternative forage source of protein and mineral. Protein content of *Azolla pinnata* is 21–37% (Khan 1988; Alalade and Iyayi 2006) and protein digestibility is 84% from total crude protein. Essential amino acid (lysine and methionine) on *Azolla pinnata* is quite high with the content of lysine and methionine of 0.98% and 0.34% respectively (Alalade and Iyayi 2006). *Azolla* is rich in macro and micromineral such as Fe, Ca, P, Mg, Cu, and Mn (NDDDB 2012), so that it has potential as a mineral supplement for ruminant (Parashuramulu *et al.* 2013).

Azolla pinnata has a short yield time (7–20 days) and a fast fresh biomass production of 390 tons per hectare a year (Ferentinos *et al.* 2002). *Azolla* has many benefits such as a biofertilizer, human food (Pabby *et al.* 2003), ruminant feed, fish food, herb (Mithraja *et al.* 2011), biogas production, and phyto remediation (Kempenet *et al.* 2013). The development of aquatic plant (*Azolla*) as an alternative forage source has a high potential to support performance and productivity of livestock. Lately, the study about *Azolla pinnata* based on media type was limited. The aim of this research is to measure production potency and protein content on several media.

MATERIALS AND METHODS

The materials used on this research consists of culture box (36×28.5×10 cm³), scale, pH meter, oven, cooling box, and furnace. The materials used were *Azolla pinnata* R Br, water, *hyponex*, *hoagland* media, and paddy field mud.

Methods of this research was designed using factorial completely randomized design with two factors. Factor A was paddy field mud 10% and factor B was media (control, hoagland, and hyponex 0,1%). The measured parameter were dissolved N media absorption, doubling time cover area, biomass production and protein content. Data were analyzed using Anova.

RESULTS AND DISCUSSION

Azolla pinnata R Br is an aquatic plant that lives well on stagnant water, such as paddy field, swamp, and lake. Mutualism symbiotic between *Azolla* plant with *Cyanobacteria* such as *Anabaena azolla* because this plant has a high growth ability (Arifin 2003). *Anabaena azollae* has a high nitrogen fixation ability from the air (van Reine and Trono 2001). The ability to grow fast and good quality improve the potential of this plant as a cultivate crop for feed. The environment condition such as the plantation media, is one of the factor that determines productivity and quality of *Azollapinnata*.

Nitrogen absorption effectivity of *Azollapinnata* on culture media

The results of N absorption from culture media showed that absorption value for each treatment was high, that is more than 97.51% from total dissolved nitrogen in media (Table 1). This high absorption value is not fully used by plant to grow. The total nitrogen content in media could be lost through several factors, such as plant immobilization, evaporation during N mineralization, and N-nitrate denitrification. The total amount of nitrogen that is absorbed by plant will affect productivity and quality of plant. Nitrogen plays an important role in forming all protein, chlorophyle, coenzyme, amino acids, and also growth hormones like cytokinin and auxin (Hanafiah 2010). A plant needs nitrogen supply at every stage of growth, moreover at early stage of growth. Cedergreen and Madsen (2002) said that aquatic plant has an ability on absorbing N element in the form of NH^{4+} and NO^{3-} through its roots and leaves.

Table 1. The absorption of N media in *Azollapinnata* culture

Media	Without paddy field mud	With paddy field mud
 %	
Control	98.38	97.51
Hoagland	99.61	99.52
Hyponex	98.67	98.77

Doubling timecover area (CA) of *Azolla pinnata* based on culture media

Azolla plant's CA doubling time is influenced by the characteristics of the planting media. Additional treatment of paddy field mud and fertilizer showed significant effect ($p < 0.01$) to the doubling time of CA as presented in Table 2. The addition of paddy field mud and manure effectively accelerate *Azolla pinnata* doubling time from 6.38 days to 3–4 days. This doubling time acceleration is reasonable because the addition of fertilizer and paddy field mud improves nutrients adequacy for plants in its metabolism process. Hardjowigeno (1995) stated that the plant productivity is very determined by the soil nutrient status and the use of

fertilizer, so the nutrient supply is adequately well. *Azolla pinnata* has replication capability in 3–10 days (Hasan and Chakrabarty 2009).

Table 2. Doubling time cover area *Azollapinnata* based on culture media

Media	without paddy field mud		with paddy field mud	
 day			
Control	6.38 ±	0.29B	4.24 ±	0.13A
Hoagland	4.06 ±	0.04A	3.91 ±	0.3A
Hyponex	4.34 ±	0.13A	4.61 ±	0.34A

Biomass production of *Azolla pinnata* base in culture media

The results showed that the addition of paddy field mud and fertilizer to the *Azolla* culture media significantly increased ($p < 0.01$) its biomass production (Table 3). The best increase in biomass production is in the Hoagland media, both with paddy field mud or without. This indicates that the nutrient adequacy in Hoagland media is better than the others. According to Taiz and Zeiger (2002) that Hoagland has a complete nutritional content consisting of macro nutrients and micronutrients. Prihantoro *et al.* (2014) stating that *Lemnaminor* productivity is optimal when added with fertilizer that contains a complete macro- and micro-minerals needed for plant growth.

Table 3. Fresh biomass production rate of *Azollapinnata* based on culture media

Media	without paddy field mud		with paddy field mud	
 g			
Control	15.31 ±	3.31C	36.64 ±	13.21AB
Hoagland	61.52 ±	6.17A	50.46 ±	12.37A
Hyponex	43.12 ±	9.55AB	44.33 ±	16.66AB

Protein content of *Azollapinnata* based on culture media

The results showed that the addition of paddy field mud and fertilizer significantly ($p < 0.05$) increase the protein content of *Azolla pinnata* (Table 4). Hoagland and hyponex fertilizer treatment is significantly ($p < 0.05$) better in improving the crude protein content of *Azolla pinnata* compared to control. This increase of protein value illustrates the plant’s high effectiveness in using plant nutrient component from the media that will have a positive impact on improving the protein content. Hoagland and hyponex are fertilizers that contain nutrients designed for leaves and roots growth where macro-micro nutrients are available to plants so that can be directly utilized by the plant. According to Parman (2007) that increased nutrients uptake will contribute to an increase in plant protein synthesis which resulted in increased protein content in plant tissues

Table 4. Crude protein content of *Azollapinnata* based on culture media

Media	without paddy field mud		with paddy field mud	
 %			
Control	14.86 ±	0.84c	19.22 ±	0.61b
Hoagland	27.19 ±	0.05a	22.24 ±	2.35ab
Hyponex	27.56 ±	2.87a	27.59 ±	0.37a

CONCLUSION

Azollapinnata has high dissolved N absorption ($\geq 97.51\%$), Additional of paddy field mud and kinds of media treatments significantly shortened doubling time cover area, biomass production and protein content compared with control.

REFERENCES

- ALALAdé OA, Iyayi EA. 2006. Chemical composition and the feeding value of *Azolla (Azollapinnata)* meal for egg-type chicks. *In J PoultSci* 5 (2): 137-141.
- Arifin Z. 2003. *Azolla*. Pembudidayaan dan Pemanfaatan pada Tanaman Padi. Jakarta (ID): Penebar Swadaya.
- Cedergreen N, Madsen TV. 2002. Nitrogen uptake by the floating macrophyte *Lemna minor L*. *New Phytology*. 155 (2) : 285-292
- Ferentinos L, Smith J, Valenzuela H. 2002. *Sustainable Agriculture Green Manure Crops*. College of Tropical Agriculture and Human Resources. Manoa (US): Univ of Hawai.
- Hanafiah KA. 2010. *Dasar-Dasar Ilmu Tanah*. Jakarta (ID): PT Raja Grafindo Persada.
- Hardjowigeno, S. 1995. Ilmu Tanah. Jakarta (ID) : CV Akademika Pressindo.
- Hasan MR, Chakrabarty R. 2009. Floating aquatic macrophytes: Water hyacinths. Di dalam: Hasan MR dan Chakrabarty R, editor. Use of algae and aquatic macrophytes as feed in small scale aquaculture- a review; 2009; FAO Fisheries and Aquaculture Technical Paper. Rome (IT): FAO. 2009. No 531. Hlm 123p.
- Khan MM. 1988. *A Primer on Azolla Production & Utilization in Agriculture*. Filipina (PH): The Univ of the Philippines.
- Mithraja MJ, Antonisamy JM, Mahesh M, Paul ZM, Jeeva S. 2011. Phytochemical studies on *Azollapinnata* R. Br., *Marsilea minuta* L. and *Salvinia molesta* Mitch. *Asian Pac J Trop Biomed*. hlm 26-29.
- [NDDDB] National Dairy Development Board. 2012. *Nutritive Value of Commonly Available Feeds and Fodders in India*. Anand (IN): Animal nutrition Group, National Dairy Development Board.
- Pabby A, Prasanna R, Singh PK. 2003. *Azolla-Anabaena* symbiosis – from traditional agriculture to biotechnology. *Indian J Biotech* 2:26-37.
- Parashuramulu S, Swain PS, Nagalakshmi D. 2013. Protein fractionation and *in vitro* digestibility of *Azolla* in ruminants. *J Anim and Feed Res* Vol. 3, Issue 3:129-132.
- Parman, S. 2007. Kandungan protein dan abu tanaman alfa (medicago sativa L) setelah pemupukan biorisa. *J. BIOMA* 9 : 2 halaman 38-44
- Prihantoro I, Risnawati A, Karti PDM, Setiana MA., 2014. Potensi dan Karakteristik Produksi Lemna Minor pada Berbagai Media Tanam dalam Peran strategis hijauan pakan lokal dalam menjamin kemandirian pangan hewani. Semnas III HITPI ; 2014 Okt 28-29; Bukit Tinggi. Hlm 219-226
- Taiz L, Zeiger E., 2002. Plant Physiology. New York (US) : The Benjamin Cummings Publishing Company.
- vanKempen MML, Smolders AJP, Bogemann GM, Lamers LLM, Visser EJW, and Roelofs JGM. 2013. Responses of the *Azolla filiculoides* Stras.-*Anabaena azollae* Lam. association to elevated sodium chloride concentration: amino Acid as indicators for salt stress and tipping point. *Aquatic Botany* 106 (2013): 20-28.

vanReine WFP, TronoJr GC. 2001. *Plant Resource of South-East Asia. Cryptogams: Algae*. Leiden (NL): Backhuys Publishers.