

ISBN 979-15949-0-5

PROSIDING INTERNATIONAL SEMINAR

*"The Role and Application of Biotechnology on
Livestock Reproduction and Products"*

Hotel Pusako Bukittinggi, West Sumatra
June 28-29, 2009



Organized By:

**Livestock Services of West Sumatra Province
Jln. Rasuna Said No. 68 Padang
June, 2009**



Wellcome Speech of Governor of West Sumatra

H. Gamawan Fauzi, SH, MM

Assalamualaikum, Wr.Wb.

Good Evening, Ladies and Gentlemen

My Honorable :

1. Minister of Agriculture of Republic of Indonesia
2. Director General of Livestock Services (DGLS), Department of Agriculture of Republic of Indonesia and Delegation.
3. Chairman Thailand IMT-GT Delegation
4. Chairman Malaysia IMT-GT Delegation
5. All Invited Speakers from Malaysia, Brunei Darussalam and Bogor Agriculture University – Indonesia.
6. All Contributing Speakers.

Firstly, on this best of occasional I would like to deliver my warm welcome to West Sumatra Province to all of participants, and my special greeting for our guest the delegation from Malaysia, Thailand and Brunei Darussalam.

Then, I would like to say my special thank you for Minister of Agriculture and Directorate General of Livestock Services that pleasure to attend this meeting in Bukittinggi, West Sumatra, so we are waiting forward to be venue other events.

West Sumatra is a province that lied all along the hill of Bukit Barisan and west coast of Sumatra Island with over than 4 million people. Minangkabau is the culture name of this province that our people sometime popular with calling as "Urang Padang or Urang Minang or Urang Awak". We have specific food with so delicious taste that we call "Masakan Padang". This food is very famous and familiar with us in Indonesia and also in many countries in the world, because we could find that foot in all of part of Indonesia, Malaysia, in Singapore around Orchard Road, Kampong Malayu and other place, also in Bunei Darussalam.

We have old philosophy in agriculture, that we call "*Padi Manguning, Jaguang Maupiah jo Taranak Bakambang Biak, Nagari tajago dan Masyarakat Aman Santoso*" that in english about "*Padi is Yellowish, Corn is mature, Livestock is multiplying, Village is keeping on and people is welfare*".

The philosophy as warranty that West Sumatran are agriculturist and we are description of the real current situation that supply our neighbor province with our agriculture product such as : cattle, egg, chicken meat, vegetable, fresh water fish, etc. Today about 60% of West Sumatran work in agricultural field as farmer, husbandry men, and fisheries. On the other hand West Sumatran also very famous as small trader/small entrepreneurship around of Indonesia, Malaysia, and Brunei Darussalam. Most of them have business in restorant or we call "Rumah Makan Padang".

Distinguish ladies and gentlemen,

Base on potencies of our natural resources, so we have priority on tourism and agriculture for developing our province. Enhance of the people living that based on local resources.

In West Sumatra, We have some institutions to support livestock development program such as : Faculty of Animal Science of Andalas University in Padang, Animal Diseases Investigation Centre Region II in Bukittinggi, TUAH SAKATO -Artificial Insemination Centre In Payakumbuh, Cattle Breeding Centre in Padang Mengatas, Limapuluh Kota. To develop and up grade our cattle in West Sumatra, we have already apply Artificial Insemination Technique since year 1975 and since year 1994 we have implemented embryo transfer for cattle that support by National Embryo Transfer Center. First calved on 1996, that bull sent to BiB Lembang to be a sire. Until now we have calved 64 embryo transfer calves. Some of them have been proven sire of bull in BiB Tuah Sakato (Tuah Sakato Artificial Insemination Center). It means we have already prepared replacement bulls by our self and have contributed bulls to other insemination center within Sumatra Island and Lembang Artificial Insemination Center in West Java. To Apply primary program on biotechnology reproduction in west sumatra province have already formed breeder clubs in every district.

Ladies and Gentlemen :

On behalf I apologize on all of inconvenient as long you stay in Bukittinggi. Hopefully this pleasure place could stimulate new inspiration and improve our cooperation.

I hope you all can enjoy your days here and wish you back to Ranah Minang in the future with your family or friends and then thank you very much for your attention and cooperation.

Then, I would like to say special thanks to all committee of this international seminar who have prepared everything and do the best for all speakers and participants.

Finally, with say Bismillahirrohmanirrohiim I open this International Seminar officially.

Thank you very much and Wabillahitaufik Walhidayah, Wassalamualaikum, Wr.Wb.

My Sincerely,

Governor of
West Sumatra Province

GAMAWAN FAUZI

Effects of Different Doses of Watering and Liming Soil on Reproduction of Three Species Earthworms

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ABSTRACT

This study was conducted in The Zoology of Laboratorium, Biology Department, Faculty of Mathematics and Natural Science, Bogor Agricultura University for 10 months from August 2000 untill May 2001. The objective of the study was to evaluate the effects of different doses of watering and liming soil on reproduction of three species earthworms; *Pheretima sp*, *E. foetida* and *L. rubellus*. The research design used was completely randomized design; the first factor was *Pheretima sp*, *E. foetida* and *L. rubellus*, and second factor was lime stone levels of 0.2% and 0.4% of media weight. The third factor was watering level (0%, 10%, 20%, and 30% of media weight) with three replications. Analisis of ovariance and orthogonal contrast were used to assess the difference among treatments. The results showed that (1) the highest clitellum devolepment was on *Pheretima sp*, although the level of lime stone and watering level did not influence clitelum development, (2) the level of lime stone of 0.4 % and watering 10% of media weight produced the highest mass production on *E. foetida*, (3) the level of watering 10% produced the highest number of offspring on *Pheretima sp*

Key words: Eartworms, liming, watering, earthworms mass production, reproduction.



INTRODUCTION

There are four species of earthworms of nine species that had development as commercial animal. These species is *Eisenia foetida*, *Lumbricus rubellus* and *Eisenia eugenia* that 80 – 90% from totally of commercial earthworms in Europe, United State and Canada, and *Pheretima asiatica* that is only development in Asia as a Commercial earthworms.

Lee (1985), state the needing of environment of soil or media of living earthworm is feeding, mousture, temperature, pH, media aeration, and soil texture. The watering for controlling of temperature and moisture. Temperature of media is appropriate in 10 – 27 0C (Razon and Razon, 1981), but the mousture that needing 50 - 80% (Kelvin,1979).

Edwards dan lofty (1977), temperature that more highest or lower was the influence of process biology as a metabolic, breathing, and reproduction. Gaddie dan Douglas (1977) state the lower moisture, the earthworm will in soil, the stopping to look for feeding and endless diet. More ever, the condition of media that more moist will cause to fight gases that characteristic of poison, and than it will danger of living earthworm or the earthworm will out in media as soon possible. The successful of cultivasi of earthworm is determine of pH.

Edwards dan lofty (1977) the earthworm is hemafrodic that each individual of reproduction male and female (Sihombing 1999). Although, for reproduction, it is needing of couple between individual of earthworm. Copulation of earthworm is very determine by clitellum that is secondary reproduction in earthworm. The copulation needing several minute, enough for out in spermatozoa in sperm pocket to couple in individually. After that, this earthworm separate and each of earthworm produced capsule. In apsule, Zigote is development of became of earthworm and finally to offspring.

The totally of earthworm that is produced one capsule depend on the total of capsule that ovulation by sperm in this casule. Gaddie dan Douglass (1977) state one earthsworm of adult or breed "*Earthworm breeder*" produced one capsule each 7 untill 10 days. Capsule of hatch 14-21 days and each of capsule can be produced 2 – 20 offspring that about 7 offspring. The offspring can be sexual maturity about 60-90 days. This old is development clitellum.

In generally, The farmer of earthworm in Indonesian can be breed of earthworm of peregrine. In Indonesian was not specially breeder that can be development that suitable with environment condition. In basically temperature, moisture and pH in very influence of level of reproduction, because of this factor of environment of earthworm is correlated with earthworm that cultivation.

Evaluation of many species of earthworm , *Pheretima sp.* local earthworm and *E. foetida* as well as *L. rubellus*, peregrine earthworm that in generally of cultivation in Indonesia in level of watering and lime stone especially in Indonesia to temperature, moisture, and pH is limit.

Because of this, this research hope to information of which one of species of earthworms that optimally reproduction in evaluation of watering land and lime stone.

MATERIALS AND METHODS

The research was conducted in zoology laboratory, Biology Department, Mathematic and science Faculty, Bogor Institute, Area of Biotrop Bogor, in ten months August 2000 until May 2001.

The earthworm used to the research was the earthworm that 5-7 days from species *Pheretima sp.*, *E. foetida* and *L. rubellus*. The media that used to was feces of cattle that dry of wind, sawdust of acasia woot and lime stone (GADDE). The composition consist of 50% feces and 50% sawdust of acasia woot. The lime stone consist of two levels (0.2 and 0.4%) from media weight as treatment. The liming stone of media was mixture with distribute in feces and soil with water added to moisture 60% and incubate in plastic in 21 days. The soil feeding of soybean waste that contain 30% in dry wind four days. The soybean waste 150% from body weight of earthworm.

There are 10 earthworms that was cultivatet in box, in size 17cm x 10cm x 10cm and had fill up media. The calculate of the needing of media based on in body of mature earthworm (a gr), The duration of cultivation (b day) and the needing of earthworm to feeding was calculated two times of body weight. And then, the needing of media (Y) was formula : $Y \text{ gr} = a \text{ gr} \times b \times 2$. The observation with each 15 days and 6 times observation. The interval of box for each unit exsperiment was 15 cm. The watering one times for three days and the needing watering depend on treatment. The mixture of media was ones per week.

When It was cultivated, It was calculated of pH, moisture, and temperature oh media each ones per two day about 11.00 PM. Beside of this, It recalculate of temperature and moisture in housing environment each day in 12.00 PM.

The method used in this study was Completely Randomized Design factorial (3 x 2 x 4); in the first factors i.e; *Pheretima sp.*, *E. foetida* and *L. rubellus*, and second factors; lime stone level of 0.2% and 0.4% of media weight. However, in the three factors was watering level of 0%, 10%, 20%, and 30% of media weight with three replication with 6 monitoring, and then the total of observation was 432 unit. Analisis of covariance and orthogonal contrast were used to assess the difference between treatments. Observation of variable i.e; (1) Clitellum development, (2) Capsule production, (3) totally of offspring

RESULTS AND DISCUSSION

Clitellum Development

The average of percentage of clitellum development from three species of earthworm; *Pheretima sp.*, *E. foetida*, and *L. rubellus* to two levels of lime stone (0.2% and 0.4%) and four levels of watering (0%, 10%, 20%, and 30%) from media weight was illustrate in Table 1.

The interaction between species with lime stone, species with watering as well as the lime stone with watering was not significant to development clitellum. The result of analysis of covariance that species of very significant ($P < 0.01$) to to clitellum development. Species *Pheretima sp* produced highest percentage of clitellum development (75.51%) than *E foetida* (46.60%) dan *L. rubellus* (46.29%).

There are very significant to clitellum development between species of earthworm, not only different of genetic but habitat factor. The habitat is suitable in *E. foetida* and *L. rubellus* in temperate region, but *Pheretima sp* in tropic region. Haukka (1987) that species *E foetida* came fromin Europ dan *L. rubellus* was Unitet State (Minnich, 1997), however *Pheretima sp* came from in Asian (Catalan, 1981).

Basically, the earthworm that came from in temperate ragon, It was more faster to sexual maturity in tropic area. In this research, a part of *E. foetida* dan *L. rubellus* had changed sexual maturity in 36 day and optimally of sexual matyryty in 51 days in temperature between 21.73°C in night until 29.38°C in day with moisture 76.50%.

It was not very different between the level of lime stone with clitellum development, and then it was indication that the earthworm was enough to lime stone 0.2% for clitellum development, but it was give to the level of lime stone for 0.4%. Base on observation, It not observation to different pH very significant between the lime stone 0.2% and 0.4%, It was follow to pH in lime stone 0.2% and 0.4% : 6.68 – 6.79 and 6.73 – 6.82, and then it was not significant to clitellum development.

The level of watering was not significant to clitellum development of earthworms. Temperature is one of the factor that very influence to clitellum development as a report of Minnich (1997), the temperature very strenght will more sexual maturity, but result of observation the different of media temperature between treatment of not significant , was not to clitellum development.

Capsule Production

The average of capsule production two species: *E. foetida* dan *L. rubellus* to two levels of lime stone (0.2% and 0.4%) and four levels of watering (0%, 10%, 20%, and 30%) from media weight was illustrated in Tabel. The result of analysis covariance was indicated that species

earthworms, lime stone, watering very significant ($P < 0.01$) to capsule production, beside of this, interaction between species with lime stone, species with watering, as well as lime stone and watering not significant. Species *E. foetida* the best product of capsule 27.7 capsule/box, compare with *L. rubellus* 25.7 capsule/box, however the lime stone 0.4% more produced capsule 27.7 capsule/box compare with the lime stone 0.2% was 25.7 capsule/box. Capsule production was high in watering 10% (36.8 capsule/box), watering 30% (20.7 capsule/box) and lower was without watering 18.3 capsule/box.

Edwards dan lofty (1997), state the total of capsule depend of species and climate. And then the condition of climate for producing of capsule depend on species of earthworms. The observation, it is indicate the average of temperature and local moisture was 28.74°C dan 76.50% , however the average of temperature and media moisture was 26.25°C dan 64.91% . This condition of environment indicate the capsule production was more in *E. foetida* compare of *L. rubellus*. The high of capsule production *E. foetida* because of high adaptation to environment condition compare of *L. rubellus*, Sihombing (1999), state *E. foetida* is species that sensitive to living temperature.

Beside of increase of pH of media, lime stone was function for supply of calcium. The increasing of composition of calcium will be influence to capsule production. Component of capsule contain more calcium. And then, increasing of this component will be influence to capsule production. In Table 1 indicated the increasing of calcium composition depend on increasing lime stone, the lime stone 0.2% produced of calcium 1.40%, however lime stone 0.4% will produced calcium 1.90%. In Addition in lime stone 0.4% from media weight will increase capsule produced compare with the lime stone 0.2%.

The condition of temperature and media moisture very influence to capsule production. Edward dan Lofty (1977) state capsule production will decrease in condition of media too dry or too wet. The observation, media without watering (C0) produced temperature $26.66 - 27.58^{\circ}\text{C}$ and moisture $33.42 - 34.75\%$, in otherhand media with the watering 30% (C3) will produced temperature $25.50 - 25.76^{\circ}\text{C}$ and moisture $81.25 - 81.67\%$. And then the condition media more dry (C0) dan more wet (C3) will produced little capsule

Total of offspring

The average of offspring of three species of earthworms : *Pheretima* sp., *E. foetida* dan *L. rubellus* that be two level of lime stone (0.2% and 0.4%) and four levels of watering (0%, 10%, 20%, and 30%) from media weight was presentation in Table 1. The result of analysis covariance was indicated that factor of species and watering very significant ($0 < 0.01$) to totally of offspring. There are interaction between species with watering. The description of interaction was the level of watering produced different response from three species. Species *Pheretima* sp was produced in offspring 41.0 earthworm/box and as follow *E. foetida* and *L. rubellus* was 32.6

earthworm/box and 28.8. earthworm/box. In the watering 10% produced more offspring 62.9 earthworm/box and as follow 20%, 30% and 0% that was 37.1 earthworm/box 34.2 earthworm/box dan 15.1 earthworm/box. And then The watering 10% from media weight produced offspring more than *Pheretima* sp. compare with *E. foetina* and *L. rubellus*. More ever species *Pheretima* sp more responsive to the watering change.

Besides of genetic factor, enviroment factor very influence to total offspring each species. In condition, different of temperature and mousture was produced of offspring each species, because of species have temperature and moisture optimal for produced activity reproduction. Edwards dan Lofly (1977) state the different temperature very influence to reproduction earthworm, beside of this, Kevin (1979) state mousture that optimally for activity earthworms was not the same for each of species.

The observation of local temperature and moisture was 28.74°C and 76.30%, however the average of media temperatur and moisture was 26.740C and 64.91%. This condition, it was different of total offspring and the more offspring in *Pheretima* sp. and follow *E. foetina* and *L. rubellus*. The high of activity reproduction especially for offspring *Pheretima* sp because this species came from Asian that trapic area, however *E. foetida* and *L. rubellus* came from temperate area.

The result of observation to media of pH in lime stone as follow 0.2% and 0.4% was 6.68-6.79 and 6.73-6.82. It was not different pH between the level lime stone, and then it was not different to total of offspring for each species. Catalan (1981), that optimal pH for earthworms was 6.8-7.2, but the increasing of pH that signficant from 7.25 to 8.25 will decrease total offspring of earthworms (Edwards dan Lofly, 1977).

The watering one of the way to controlling of temperature and moisture of media. Because of temperature and media of optimal can be the optimally of reproduction. Actually, The earthworms is terestially animal, it is condition of long dry that will decrease offspring (Edwards dan Lofty, 1977). It is condition, the earthworm need the wateringr not only maintain temperature and moisture that optimally as well as consumption. Result of in this research that totality of offspring was a little in condition without watering. It was not conclusive of temperature and moisture. This observation of temperatur and moisture without watering (C0) 26.96 – 27.58°C and 33.42 – 34.75%. Because of the low of moisture, it will be a little offspring.

It was least of offspring from not the watering and the watering 30%, because of the little of produced capsule. The level of watering that optimally was the watering (C1) from body weight, in media temperature and moisture 26.96 – 26.380C and 66.42 -- 67.25% that produced more offspring .

CONCLUSION

The result of the research indicated that the best of development of clitellum was species of *Pheretima sp*. Although, level of lime stone and watering was not influence to clitellum development. The hight of capsule produced was *E. foetida* in level of lime stone 0.4% as well as level of watering 10%. *Pheretima sp* more produced offspring in level watering 10%.

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