IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)
e-ISSN: 2319-2380, p-ISSN: 2319-2372. Volume 9, Issue 4 Ver. I (Apr. 2016), PP 24-30
www.iosrjournals.org

Productivity Index of Etawah Crossbred Goats at Different Altitude in Lumajang District, East Java Province, Indonesia

Sumartono[1], Hartutik[3], Nuryadi[3],Suyadi[3]
[1] *Postgraduate Student Faculty of Animal Husbandry, Brawijaya University Malang and*
[2]*Lecturer of Faculty of Animal Husbandry Islamic University of Malang*
[3]*Lecturer of Faculty of Animal Husbandry Brawijaya University Malang*

Abstract: *Productivity index ofEtawah crossbred does at lowland (<400 mabove sea level/ASL), middle land (400-700m-ASL) and highland (>700m-ASL) in the Regency of Lumajang, East Java, Indonesia was evaluated by measuring the litter size, weaning weight, kidding interval and mortality of pre-weaning kid. This study was conducted in the district of Lumajang.Materials used in this study were 180 does of Etawah crossbred and the 323 kids owned by the Farmer.The methods used in this study were survey and direct field observation.The aim of this study was to analyze productivity index of does of Etawah crossbredin lowland, middle land, and highland in the Regency of Lumajang.The result of this study showed that the average litter size is 1.75±0.43;1.80±0.40 and 1.85±0.36 (P>0.05), the preweaning mortality percentage 4%; 2% and 0.5%, the average of weaning weight was 10.75±2.36 kg;11.53±1.67 kg and 12.92±2.86 kg(P<0.01), the average of kidding interval was 9.38±1.10 months;8.90±1.13 months and 8.56±0.59 months (P<0.01), productivity index of does of Etawah crossbred per year was23.28±5.51kg/year; 27.89±5.10 kg/yearand 33.46±7.72 kg/year (P<0.01) in lowland, middle land and heigland respectively. It is concluded that highest productivity index of Etawah crossbred does in was observed when the goats were reared in highland area than at middle and lowland area.*

Key words: *Altitude, liter size, weaning weight, kidding interval, does productivity index*

I. Introduction

Etawah crossbred (PE) goat is the type of local goat in Indonesia that has the good development prospect to support the economy of local farmer. This goat is the crossbred between Kacang goat and Etawah goat (Jamnapari) which is expected to increase the productivity. Based on Barlet (2007), Fahmi (2007), and Syawal (2010), crossbreeding is a way to improve the productivity of local goats with other goats that have superior characteristics. This step is done with the aim to improve the nutrition of local community which in the further development is exploited as a dual-purpose livestock that is as a source of meat and milk. In order to develop and improve the productivity of PE goats, reproduction performance plays an important role if it is associated with increasing production of livestock. PE goat livestock production in Indonesia is generally operated by livestock farmers in rural areas. Business of the farming remains the main pedestal in order to increase the population of PE goats, so that the necessary efforts to increase the productivity of goats are needed, which in turn, can increase the income of farmers.

Livestock productivity is influenced by genetic factors and environmental factors. Environmental factor that affect livestock productivity, among others, is the level of land that is directly related to the comfort of living cattle. Environmental factors affect quite significantly the level of production. The main environmental factors that affect livestock production are temperature, humidity and solar radiation, and wind (Hulme, 2005). In the tropical area, where many are characterized by high levels of solar radiation and temperature, heat stress is the major factor restricting the development and production of livestock. Topographical conditions in East Java region vary widely, but in general it is more dominated by the topography of the mountain. This is because East Java is the path of Southern mountains, with a maximum ground level elevation + 3637 m (mountain peak Mahameru) which is located in the Lumajang area. From 29 districts and 9 cities in East Java, the goat population varied in number, from 1,310 to 222,019 and the total number of goat population in East Java reaches for 2,937,980 (Directorate General of Animal Husbandry, 2013). Sumartono, *et.al* (2015) has reported that the altitude may influence the potential of production and reproduction.

The diversity of goat population in East Java happens because of different management factor in each area so it results in different reproduction, and will affect to livestock (goat) production process, which eventually also affects the high and low efficiency of production and reproduction in each region. The district of Lumajang, JawaTimur, Indonesia, is a region which has potential in the development of farm business; among others is PE goat farm. PE goat farm is a competitive commodity and the main income source of cattlemen community in district of Lumajang. Goat farm business donates the income of the cattlemen up to 28%. Almost 95% farmers have goat farm business with 5 – 10 goats/farmer. Goats have potential as an important component of farming

business in various agro-ecosystems because it has a good ability to adapt relatively well compared to other ruminants, such as cows and sheep (Ginting, 2009).

II. Research Method

The study was conducted in Regency Lumajang –East at three different altitude District Sumbersuko (<400 m Asl), Pasrujambe (400-700m,Asl) and Senduro (>700m, ASL) at the dairy goat farmer condition. The goat farmer were characterized as small scale farmer with the member of animal of 8-10 per farmer. The goats their living consisting three leafs and leguminose withaut any additional concentrate. The study was conducted by survey method by observing directely to the animaly and interviering the farmers. Farmer and animal sumples were drawn by purpossive sumpling for those three districts location with the member of does was 180 (60 does of each district) andd 323 kids . The does selectetd in this study was more than 3 years old of age, while the kids were observed from the day 1 of their ages. Variable observed in this study were litter size, weaning weight, kidding interval and mortality of pre-weaning kid.
Data collected then analyzed by ANOVA and used SPSS.13 (Statistical Package for the Social Sciences) program.

Corrected weaning weight

Corrected weaning weight. Based on Hardjosubroto (1994), corrected weaning weight can be ditermined by using the following formula:

$$\text{CWW} = \{\text{BW} + \frac{\text{AW} - \text{BW}}{Age} xAWAxBCFxDaCFxSCF$$

CWW = corected weaning weight
AW = actual weight
BW = birth weight
Age = age of weaning
AWA = average weaning age
BCF = birth type corection fractor
DaCF = does ' age correction factor
SCF = sex correction factor

$$Parent\ Reproduction\ Index\ (PPI) = \frac{LSx(1 - M\%)}{kidding\ interval\ (years)}$$

Description:
LS = Litter Size
M = Mortality

Parent Productivity (PI)= PPI x Weaning Weight
(Sutama, 2007)

III. Results and Discussion

General Situation of Research Sites

This study was conducted in Lumajang in East Java Province of Indonesia in the highlands (>700 m ASL), middle land (400-700 mASL) and lowlands (<400 mASL), that the enclosure temperature, humidity, and Temperature Humidity Index (THI) are presented in Table 1.

Table 1. Altitude, temperature, humidity, and THI in the district of Lumajang

Location	Altitude	Enclosure Temperature(^{0}C)	Humidity(%)	THI(^{0}C)
District of Lumajang	>700 m ASL	19.96±1.26^a	71±1.84	18.46±3.99
	400 – 700 m ASL	26.93±4.12^b	66.08±1.13	25.10±3.85
	0 – 400 m ASL	28.5±0.87^c	65.6±10.71	26.57±0.65

Description: ^{abc} different superscripts in the same column show highly significant difference(P <0.01)

Air temperature and humidity in the cage at different altitude in Lumajang show a highly significant difference (P <0.01) that the higher the ASL (above sea level), the lower the air temperature while the humidity is higher. As stated by Gregory (1961) and Payne (1970),the higher an area above the sea level, the lower temperature will be. Table 1 shows that the higher the altitude, the lower the temperature. The content of the elements of air (O_2, CO_2, N_2, Ar) will decrease with the higher places, causing lower air temperature. Air is poor heat storage, while the earth's surface is a good conductor, so that the air temperature is strongly influenced by the earth's surface. Therefore, the process of heat transfer was more effective at warming the earth's surface compared to the air. This is in accordance with the opinion of Handoko (1995) which at that the higher the location of a place, the lower the air temperature. According to Kartasapoetra (1993), the factors influencing the

temperature at the earth's surface are: 1) the amount of radiation received per year, per day and per season, 2) the influence of land or sea, 3) the effects of wind indirectly, 4) the effect of latent heat, the heat stored in the atmosphere, 5) ground cover, the soil is closed vegetation having a temperature lower than the soil without vegetation, and 6) the type of soil, black soil has a higher temperature index. THI is the relationship of the amount of temperature and humidity that make the livestocks live comfortably (Wierema, 1990, Marai*et.al*, 2002).

The most suitable air temperature of environment for cattle in the tropics is 10°C - 27°C (Sientje, 2003), the comfortable ambient temperature for cattle ranges from 18°C - 30°C (Smith and Mangkoewidjojo, 1988), while according to Nieuwolt (1975), the area was said to be comfortable if it has a value of THI between 21^0C - 27^0C. The value of THI in Lumajang, in lowlands, medium, and highlands was convenient for cattle, but there is a tendency in the lowlands approaching the not safe zone which means temperature of the enclosure is hotter when it is compared with the temperature of the enclosure in the medium and highlands. From 180 does of Etawah crossbred (PE) goats which were spread over 3 sub-districts in Lumajang, the average number of kids born per birth is found (Table 2).

Table 2. The average number of kids per birth of doesEtawah goat crossbred located in 3sub-districts in Lumajang

Location	Altitude	N	Mean±SD
District ofLumajang	>700m ASL	60	$1.85^a \pm 0.36$
	400-700m ASL	60	$1.80^a \pm 0.40$
	<400 m ASL	60	$1.75^a \pm 0.43$

Description: [a] similar superscript in the same column shows unreal differences (P> 0.05)

From Table 2, Litter Size between highland, medium and lowlands in Lumajang showed no difference (P> 0.05), but in the highlands there was a higher tendency when compared with medium and low-lying, litter size on highland is 1.85 which was higher than the finding of Sodiq's (2010) study which showing 1.78 of litter size. In the middle lands, the litter size is 1.80, which was similar to the research conducted by Sukendar*et.al* (2004) showing that litter size in middle lands is 1.83. In the lowlands, the litter size is 1.75, which was smaller when it is compared with the research conducted by Sodiq (2010) showing that in the lowlands, the litter size is 1.89. The number of kids born of a mother in the highland, middle and lowland was influenced by the number of fertilized ovum by the mating time, and was also influenced by genetic and environmental factors and the factor of interaction (Hardjosubroto, 1994). In addition, Nalbondav (1990) states that litter size depends on the number of ovum which are ovulated, fertilized, the ability of ovum to split and do implantation, and those able to survive during the pregnancy, as a result, the number of birth will be higher.

Kostman*et.al* (2003) state that litter size was also influenced by race, parent age, weight, and body size. From the research conducted by Sutama*et.al* (1995) on young female PE goat, litter size is 1.04 and according to the research by Dewendra and Burns (1994), each kilogram increase of average weight will increase 0.03 average ovulation numbers. According to Bradford *et.al* (1991), the diversity of litter size occurs because of the different frequency of fertility gene carrier. The higher the frequency of fertility genes carrier, the higher the average litter size will be.

Birth weight has very important meaning since birth weight is correlated with the growth of the kid after birth up to adult size, and correlated with the ability of the kid to survive. According to Gatenby (1991), a large birth weight influences the ability to survive and acceleration of weight gain in infancy. The mean and standard deviation of birth weight on the highlands, middle land and lowlands in Lumajangwere shown in Table 3.

Table 3. Average birth weight (kg) in the highlands, middle land and lowlands in the district of Lumajang

Location	Altitude	N	Mean±SD
District of Lumajang	>700m ASL	60	3.23 ± 0.71^a
	400-700m ASL	60	2.88 ± 0.41^b
	<400m ASL	60	2.68 ± 0.59^b

Description: [a,b]different superscripts in the same column shows a highly significant difference (P <0.01)

Statistical analysis result on Table 3 showed that birth weight in the highlands (3.23 ± 0.71 kg) was significantly different (P <0.01) from middle land (2.88 ± 0.41 kg) and lowlands area (2.68 ± 0.59 kg). Meanwhile, medium and lowlands show no significant difference (P> 0.05). There was a difference in birth weight value between highlands, middle land, and lowlands. The difference occurred because in highlands, there were enough forage in highlands which was sufficiently provided before the birth so that feed consumption at highlands is higher, while the availability of forage in the lowlands and middle more difficult at the moment before birth to provide adequate feed although the type of feeding was similar but they have different qualities. Observations in the field found that in the highlands feeding was adlibitum as feed is directly taken from the land, while in the middle land and lowlands feeding is given only once without any additional feed if the feed is

up, because owned land is limited for cultivation as animal feed. As stated by Ensmenger*et.al* (1990), a combination of genetic and environment factors showed differences in livestock performance and it could affect growth, development and production of livestock.

Birth weight in highlands in Lumajang was higher when compared with the results of research on Sudan goats in highlands by Wilson RT (1976) that is 2.1 kg, also when compared with the results of research of Ethiopia goat in the highlands by Mukasa-Mugerwa (1986) of 2.5 kg, and research by LA Mtenga (1991) of 2.5 ± 0.3 and the research on Zimbabwe goat by Khombe CT (1985) that is 3.0 kg. Birth weight of PE goats in the highlands, medium and lowlands when compared with the research of Tomaszewka*et.al* (1991) and IndraSulaksana (2010) was higher at 1.8 -2.6 kg and 2.33 ± 0.45 kg. Research result on the lowlands in Lumajang was higher when compared with the result of research by Mtenga (1991) in the lowlands that is 2.0 ± 0.6 kg. Birth weight variation is fairly high due to the influence of gender, parity and feeding time during pregnancy, the body size of the mother during childbirth.

Weaning weight is the weight at the time the care of the kids is separated from their mothers. The average of weaning weight of PE young goat in Lumajang can be seen in Table 4.

Table 4. The average weaning weight (kg) in the lowlands, middle land and highland in Lumajang

Location	Altitude	N	Mean±SD
District of Lumajang	>700m ASL	60	12.92 ± 2.86^{a}
	400-700m ASL	60	11.53 ± 1.67^{b}
	<400m ASL	60	10.75 ± 2.36^{b}

Description: ^{a,b} different superscripts in the same column shows a highly significantdifference (P <0.01)

The result of statistical tests shows that the average weaning weight of young goat in Lumajang on the highlands shows a highly significant difference with the medium and lowlands (P <0.01), but in the middle lands shows no significant difference with lowland (P>0.05). The difference in weaning weight between highland and lowland in Lumajang occurs because birth weight in the lowlands is lower than that of the highlands, so it affects the growth. However, compared with the research by Sutama*et.al* (2003), the average weaning weight of PE young goats in the lowlands in Lumajang is 10.75 kg, which is slightly higher than Sutama's research finding showing that the weight of PE goat is 10.70 kg. Weaning weight differences between highlands and lowlands are caused by different genetic and environmental factors since weaning weight is influenced by variations of kid birth weight and condition of the parents' body (Liu *et.al*, 2005; Gifford *et.al*, 1990).

Table 5.Kidding interval (month) in lowlands (<400 m ASL), middle land (400-700 m ASL) and the highlands (>700 m ASL) in the district of Lumajang

Location	Altitude	N	Mean±SD
District of Lumajang	>700m m ASL	60	8.56 ± 0.59^{a}
	400-700m ASL	60	8.90 ± 1.13^{a}
	<400m ASL	60	9.38 ± 1.10^{b}

Description: ^{a,b} different superscripts in one column shows a highly significant difference(P<0.01)

Kidding interval is the interval of two births in sequence from one process of delivery to the next birth. Kidding interval becomes determining factor of the level of the average production of kids per year. The result shows average kidding interval from three different areasin Lumajang, as follows: (1) highlands is of 8.56 ± 0.59 months; (2) middle land is of 8.90 ± 1.13 months; and (3) lowlands is of 9.38 ± 1.10 months. The results of statistical test is showed in Table 3 that kidding interval in the highlands and lowland has a highly significant difference (P <0.01), while in the highlands and middle land did not show differences (P> 0.05). The different results between the highlands and middle lands and the lowlands happened because in the lowlands breastfeeding period was longer than the highlands and middle land. Insufficient food was considered as the main cause for bad growth and kids' death. This was in accordance with the opinion of Dewendra and Burn (1994) stating that there were several factors that led to the death of the kids, among others are cold, lack of food, disease and dystocia, while according to Sutama (1997), goats were very susceptible to changes in environmental conditions. With a length of breast-feeding on its mother, it would cause lust withdrawn and marriage became delayed so that the birth spacing became longer. This was in line with Astuti's (2007) statement that parents' pending marriage affected the birth spacing. Birth spacing was also influenced by the post-partum estrous, S/C and the period of pregnancy.

Productivity of doeswas kids' live weight produced by a does or a group of goat per year which combines kidding interval, number of litter size and live weight at a certain age (weaning age). Parent Reproductive Rate (LRI) was the description of the parent's ability to care for the kid until weaned. Productivity of does in Lumajang highlands, medium and lowlands can be seen in Table 6.

Based on the interview, the death of the kid until weaned in the highlands, middle and lowlands were 0.5%, 2% and 4% respectively. This low mortality of kids was due to the adequacy of the mother's milk production for the survival of the child because the farmers give the priority on the safety of kids before weaned, that is the mother's milk production. This is in accordance with the opinion of Synaman (2010). Factors that might be involved in the survival rate of a kid is the birth weight, genetics, parenting abilities and mother's milk production, the environment, nutrition, disease, and predators.

Table 6. Average Index of Reproduction and Productivity does PE goats until age weaned at highlands, medium and lowlands in Lumajang

District	Altitude	N	Birth Spacing (Month)	Liter Size	Weaning weight (Kg)	Mortality (%)	Reproduction Index	Productivity (Kg)
Lumajang	>700m ASL	60	8.56	1.85	12.92	0.5	2.58	33.34
	400-700 m ASL	60	8.9	1.8	11.53	2	2.37	27.42
	<400m ASL	60	9.38	1.75	10.75	4	2.15	23.10
	Average		8.95	1.8	11.73	2.17	2.37	27.95

Based on Table 6, the harvest kid per breeding in Lumajang the highest per year was at highlands for 33.34 kg live weight. Thus, the overall average productivity of dairy goat parent (PE) in Lumajang was 27.95 kg live weight. High and low productivity of goats was influenced by genetic and environmental factors, according to Devendra and Burns (1983) birth weight was an important factor affecting the productivity of the goats while according to Wilson (1960) the development of the kid from its birth to weaning was influenced by nutritional it consumes. The diversity in the supply of food and in feeding and different management in highlands, medium and lowlands could affect the efficiency of the conversion of nutrients by the parent to be the weight of the fetus, which will affect birth weight and weaning weight in the future so that it will also affect productivity.

When high reproduction index value and the average of weaning weight become too high, it will generate an index value of a high mothers' productivity. The result of the study (Table 6) in terms of the index of reproduction in Lumajang at highlands (2.58) was better than the reproductive index in middle lands (2.37) and also lowlands (2.15). It was in accordance with the research by Sodiq (2010) showing that the highlands reproductive index (2.67) was better compared to the lowlands (2.03). The difference in reproductive index value is due to the earlier pregnancy after birth in highlands. As a consequence, birth spacing at highlands is shorter compared to middle or lowlands which the birth spacing is longer.

Does productivity figures can be used to measure the ability of the does in one location to produce kids with certain weight. Differences in productivity of PE does at a height of different places is caused by litter size, mortality, kidding interval and weaning weight. This can be seen in Table 2, 3, 4 and 5, which indicates that the highland results are better when compared to medium and lowlands. The higher litter size, the higher the productivity of the parent. Conversely, the lower the mortality of pre-weaning kids will increase the productivity of parents, the shorter kidding interval will increase the productivity of the parents.

Greyling (2000) and Marai*et.al* (2002) report that production performance is largely determined by the interaction of genetic factors, as well as the very real effect of parity on the productivity of goats. In the highlands, high birth weight and weaning weight are highly significantly different ($P < 0.01$) compared with the medium and low, it can affect kids' growth until weaning. The research result of Ndlovu and Simela (1996) indicated that lower growth rate of the kid and more length of birth spacing resulted in the decrease of does productivity to make weaned kids' weight gain within certain period. The average productivity goat mother increased as the increase in parity to parity fourth and fifth, then gradually declined. Steve and Marco (2001) showed that level of productivity of a goat can be correlated positively with age maturity of the parent, and its ability dropped dramatically after the mother is 9 years old.

IV. Conclusion

The amount of litter size, birth weight, weaning weight, mortality, and kidding interval in highland is better than middle and lowlands area of Lumajang. It can affect the does' productivity index, which show that does' productivity index in highlands is better than that of middle and lowlands.

Acknowledgement

To the Honorable Prof. Dr. Sc. Agr. Ir. Suyadi, MS., Dr. Ir. Nuryadi, MS and Prof. Dr. IrHartutik, MP as advisor in the process of writing this journal who have given all facilities patiently and willingly, provided direction and motivation to start writing until the completion of the writing of this journal article.

References

[1]. Amir P and HC Knipscheer. 1989. Conducting On-Farm Animal Research: Procedures and Economic Analysis. Winrock International Institute. Agric. Dev. and Int. Dev. Res. Centre.Singapore National Printers Ltd., Singapore.
[2]. Barillet F. 2007. Genetic improvement for dairyproduction in sheep and goats..Small Rum. Res.70:60–75.
[3]. Bradford, G.E., I. Inounu, L.C. Iniguez, B.Tiesnamurti, and D.L. Thomas. 1991.The prolificacy gene of Javanesesheep. p. 67-73. In J.M. Elsen, L. Bodin,and J. Thimonier (Ed.). Major Gene forReproduction in Sheep. 2nd Inter-national Workshop, Toulouse, France,16-18 July 1990. Institute National DeLa Recherche Agronomique, Paris,France.
[4]. Devendra,C and M .Burns .1983.Goat Production in the Tropics. Commenwealth Agricultural Bureaux,London
[5]. Devendra, C dan M. Burns. 1994. Goat Production in the Tropics.Translated by IDKPutera. Publisher Bandung Institute of Technology and the University of Udayana.
[6]. Department of Animal Husbandry Prov. East Java in 2013 Jl. Gen. Ahmad Yani 202 60 235 Surabaya East Java Indonesia.
[7]. Ensminger, M E., J. E. Oldfied and W.W. Hineman. 1990. Feed and Nutrition (Formaley Feed Feed and NutritionCompleted). 2nd Ed. The Ensminger Publishing California, California.
[8]. Gatenby, R.M. 1991. SheepThe Tropical Agriculturalist. Mac Millan Education LTD London UK. Cooperation with CTA. Wagenigen, Netherland.
[9]. Georgory, K. E . 1961. Improvement of Beef Cattle Throughout Breeding Method. Regional Publication 120. USDA Greyling, J.P.C., 2000. Reproduction traits in the Boer goat doe. Small Rum. Res.36:171-177.
[10]. Giffort. D.R. Ponzoni R.W., Bun J and Lampe R.J. 1990. Environmental effect and fleece and body traits of Souts Australian Angora goats; Small Ruminant Research (3):249- 256.
[11]. Ginting, S. P. 2009. Technical Guidelines for Parent and Child Maintenance Period Pre-Wean Goat Research Local Goat. North Sumatra.
[12]. Greyling, J.P.C., 2000. Reproduction traits in the Boer goat doe. Small Rum. Res.36:171-177.
[13]. Handoko. 1995.Basic Climatology. Jakarta: PT. Dunia Pustaka Jaya.
[14]. Hulme, P.E. 2005. Adapting to climate change: is there scope for ecological management in the face of a global threat. Journal of Applied Ecology 42: 784–794.
[15]. Indra Sulaksana. 2010.Child Growth Goat Etawa Grade (PE) Up to Age 6 Months in Rural Livestock Production Department, Faculty of Animal Husbandry, University of Jambi CampusPinang Masak, Mendalo Darat, Jambi 36361.
[16]. Hardjosubroto, W. 1994. Livestock Pemuliabiakan Applications in the Field. PT. Grasindo Jakarta.
[17]. Kartasapoetra. 1993. Introduction to Climate. Fifth edition. Gadjah Mada University Press.Yogyakarta.
[18]. Kostaman, T., Keman, S., Sunardi dan I.K. Sutama. 2003. Appearance Goat Reproduction Mated to a Peranakan Etawa the Boer Goat males and Growth son to Wean. Thesis. Gadjah Mada University Graduate Program.Yogyakarta.
[19]. Khombe C T. 1985. Environmental factors affecting the growth and viability of crosbreed Shep and goats on range grazing in Zimbabwe. In: R T Wilson and D Bourzat(eds.), Small ruminants in African agriculture.International Livestock Centre for Africa, Addis Ababa, Ethiopia.
[20]. L.A. Mtenga and G.C. Kifaro. 1991. Dair Goat Research and Extension atUnivegriculture (lowland) Univegriculture (lowland) and Mgeta (highlands) areas of Tanzania.Departement of Animal Science and Production Sokoine University of Agriculture, Morogoro, Tanzania
[21]. Liu W, Y Zhang and Z Zhou. 2005. Adjustment for non-genetic effects on body weight and size in Angora goats. Small Rum. Res . 59(1):25-31.
[22]. Marai, I.F.M., Abou-Fandoud, E.I., Daader,A.H., and Abu-Ella, A.A. 2002. Reproductive Oettraits of the Nubian (Zaraibi) goats in Egypt. Small Rum.Res. 46:201-205.
[23]. Mukasa-Mugerwa E, Bekele E and Tessema T. 1986. Productivity of indigeneus sheep and Goats indigenous sheep and goats in the Ada District of the Ethiopian Highlands In:KO Adeniji and J AKategile (eds.). Proceeding of theworkshop on the improvement of small ruminants in Eastern andSouthern Africa. Organisation of African Unity/International Development Research Centre, Nairobi, Kenya.
[24]. Nalbandov. 1990. Physiology of Reproduction in Mammals and Poultry. Translated by S.Keman. UI-Press, Jakarta.
[25]. Ndlovu and Simela. 1996. Effect of season of birth and sex of kid on the production of live Weaned of live weaned single born kids in smallholder East African goat flocks in North East imbabwe. Small Rum.Res. 22:1-6.
[26]. Nieuwolt, S. 1975. Tropical Climatology : An Introduction to The Climate of The Low Latitudes The Low Latitudes. John, W and Sons. New York.
[27]. Payne, W.J.A. 1970. Catle Production in Tropic Vol 1. Longhman London
[28]. Sientje.2003.Effect of Altitude Physiology Against Goat. Papers Philosophy of Science (PPs 702) Graduate Program / S3 Bogor Institute of Agriculture in May 2003.
[29]. Sodiq, A.2010. Improving Livestock Production System of Peranakan Etawah Goat Rarming For for Increasing Accessibility to Bank. In: Proceedings International Seminar on Prospects and Challenges of Animal Production in Developing Countries in the 21st Century, Malang, March 23-25.
[30]. Shrestha JNB and MH Fahmy. 2007. Breeding goats for meat production:a review (3). Selection.Selection and breeding strategies. Small Rum.Res. 67:113–125.
[31]. Sukendar, A. 2004. Productivity and Population Dynamics Peranakan Etawah Goats in the village Hegarmanah, Cicantayan District of Sukabumi. Faculty of Animal Science, Bogor Agricultural University, Bogor.
[32]. Sumartono dkk. 2015. Potential Analysis Production and Reproduction Goats Etawa Grade(PE) in East Java. Dissertation Faculty of Animal Husbandry Graduate Program Brawijaya University in Malang.
[33]. Sutama, I-K., I-G.M. Budiarsana, H. Setiyanto dan A. Priyanti. 1995. Research Results 1994/1995 state budget. Livestock Research Institute. Centre for Research and Development of Animal Husbandry. p. 259-270
[34]. Sutama, I.K., B. Setiadi., I.G.M Budiarsana, and U. Adsiati. 1997. Sexual Activity After Give Birthon dairy goats Etawa Gradewith Different Level of Milk Production. Proceedings. National Seminar on Animal Husbandry and Veterinary, Volume II. Centre for Research and Development of Animal Husbandry Bogor. p. 401-409
[35]. Sutama, I, K. 2007. Challenges and opportunities for increased productivity through technological innovation goat reproduction. Proceedings. National Workshop Goat. Research and Development of Animal Husbandry, Bogor.
[36]. Steve, D.C. and Marco, F.B.. 2001. Reproductive success in female mountain goats: the influence of age and social rank. Anim. Behaviour 62:173-181.
[37]. Syawal M. 2010. The Morfology Characteristic and Production of Kacang Goat, Boer and the Crossat pre-weaning. In: Proceeding of NationalSeminar on Animal Farming and VeterinaryTechnology. Bogor, 3-4 August 2010. p: 616-620 (in Indonesian with abstract in English).

[38]. Synman, M.A. 2010. Factors affecting pre-weaning kids mortality in South African Anggora. Outh African Journal of Animal.
[39]. Tomaszewska, M.W. I.K. Sutana, I.G. Putu dan T.D.Chaniago. 1991. Reproduction, Behavior, and Livestock Production in Indonesia. PT. Gramedia, Jakarta.
[40]. Wierema. 1990. Feeding Strategies to Combat Heat Stress. Ontario Ministry of Agriculture and Food. Ontario.ca.Francais.
[41]. Wilson, P. N. 1960. The effect of plane of nutrition on the growth and development of the east African dwarf goat. III. The effect of plane of nutrition and sex on the carcass composition of the kid at two stages of growth, 16 lb. weight and 30 lb. weight. J. Agric. Sci. (Camb.) 54:105.–130.