International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2016): 79.57 | Impact Factor (2017): 7.296

Effects of Nutritional Improvement of Pre-Mating Etawah-Crossbreed Goat on Feed Intake, Feed Digestibility and Productivity

Suhartini[1], Rusdi[2], Damry[3], Marsetyo[4]

Doctoral Program of Agricultural Science, Graduated School, Universitas Tadulako, Palu 94118, Indonesia

Abstract: ***One approach that could be applied to improve goat productivity is the improvement of nutritional status of goat. Gliciridia forage as a protein supplement was fed to etawah crossbreed goat, during premating period to the gestation period. A total of 60 goats were placed in individual cages and refer to the Completely Randomized Design within factorial pattern. The first factor was parity; once birth (PS_1), twice birth (PS_2) and third birth (PS_3), while the second factorwas type of the diets; maize forage only (MF) and maize foragewith the addition of gliciridia forage (GF) on the maize based dietsin 20 replicates. The results indicated that parity and diet type independently gave a significant effect (P<0.05) on the dry matter intake. Supplementation with gliciridia forage elevated significantly (P<0.05) dry matter digestibility and increased (P>0.05) organic matter digestibility. There was no interaction (P> 0.05) between parity status with supplemental feeding of gliciridia on the dry matter and organic matter digestibility, but there was interaction to litter birth weight. Multiparous goat had higher the number of conception rate, twin-litter and litter size with lower the rate of embryo mortality. It was concluded that nutritional improvement in general could improve feed intake and feed digestibility and productivity of etawah-crossbreed goat.***

Keywords: Productivity, gliricidia, parity, litter size, conception

1. Introduction

The ability of goat to delivery twins-litter is very potential to increase the productivity of goat. This twin-genetically goat is expected to be developed widely and sustainably to accelerate goat productivity and goat populations in Central Sulawesi province in particular and in Indonesia in general. Increasing the productivity of local goats can be done through genetic improvement by good selection, improved feeding (quantity and quality), and management. All three factors must be put together in order to achieve optimal production. Nevertheless, the problem faced by the goat breeders is the high deaths of twins-litter during pre-weaning period. Sodiq (2010) reported that pre-weaning mortality rates ranged from 6.04 to 9.43% in the area of Karesidenen Banyumas Central Java and preweaning mortalities were commonly in twin-born litter compared to the single-born. While Setiadi and Sitorus (1984) and Handiwirawan *et al*. (1996) reported that preweaning mortality was 34.23% and 45%, respectively. This is because a single born-litter has more chance to get more milk from his does than a twin-born. Handiwirawan *et al*. (1996) reported the deaths of litter commonly found in goat fed with low protein levels and without micro mineral supplementation. Therefore, it is necessary to examines the problemsin the traditional goats farms to reduce litters mortality during pre-weaning period.

The productivity of goat can be measured through litter birth weight, weaning weight and litter size and litters survival until weaning (Sumediana *et al*., 2000). The goat productivity can be calculated from life weight of the litters during the pre-weaning period, based on the assumption that the growth of the litters during pre-weaning period is highly dependent on the production of the goat's milk. The productivity can also be assessed by weaning weight of the litters. This measure describes the goat's ability to raise their litters(Setiadi *et al*., 2001).

The growth of the litter from birth to the weaning is a critical period, its survival and growth depend on the nutrient received from the goat's milk. Pre-weaning period (aged 1 - 10 weeks) requires 1.2 to 1.6 liter / head / day (Devendra and Burns, 1994). Factors affecting the survival of pre-weaning litters are birth weight, genetics, mothering ability, mother's milk production, environment, nutrition, and predators (Syuman, 2010). Another factor closely related to goat productivity is the mortality rate of the litters (Gall, 1981). Pre-weaning litter deaths could reach 10 - 50% (Adriani *et al*., 2003). The mortality rate of litter at triplets and four letters is 26- 43% higher than in single or twin births of 17 - 18%. Age 0 - 3 days is a critical period for young litter, in this period, the death of litter often occurs, especially in young litter that are lacking and or not getting colostrum milk. Colostrum plays an important role in endurance and growth of young litter during pre-weaning and post weaning period (Sutama *et al*., 1993). The conditions can only be achieved if the goat condition is good enough to supporting embryo survival and high milk production. Preparation of goat with good body condition can be done before mated, gestation, and postpartum period. Therefore, improvement of the quantity and quality of the diet given during such periods may improve the condition of the goat, so that it is expected to provide a better life expectancy for the litters (born single or twin) and pre-weaning litters mortality rate can be suppressed.

2. Materials and methods

Experimental goats had previous litters. A total of 60 etawah crossbreed goat (mean body weight of 21.27 kg) that intra-muscularly injected with 2 cc/head of Biosolamine were placed in individual cages based on the Completed Randomized Design within Factorial Pattern in 20 replications. The first factor was parity; first birth (PS_1),

second birth (PS_2) and third birth (PS_3). The second factor was the type of the diets; maize forage only (MF) andmaize forage with gliricidia forage supplementation (GF). Drinking water and maize forage were freely available during experiment period. Chemical composition of forage is presented in Table 1.

Four weeks were adaptation period. Feeding treatments was done three weeks before the mating period and continued until kid weaning. Mating program was done by using an Intensification of Natural Mating. Mating goat was repeated for not pregnant goat on the next estrus days after the first mating. Goat does not show signs of estrus then declared that pregnancy has occurred. At the age of pregnancy 24, 48 and 69 days was held examination by seeing a sign of estrus, if no more signs of estrus, then declared pregnant. Three bucks, 3-4 year old, were used during mating period.

Selected goats that have been mated at the first stage of the study and already known to pregnant, they were fed maize forage *ad-libitum* with and without supplementation of 1% gliciridia forage based on body weight during the study. Maize forage was given after the provision of gliciridia forage consumed. Offered and residual feed were weighed and recorded daily. Feed intake and digestibility were carried at the pre-mating period. Other variables are litter size, birth type, mortality during pregnancy and birth weight of the litter.Data on dry matter intake, digestibility and litter birth weight of the litters parameters were analyzed using the General Linear Model (GLM) procedures of the Statistical Analysis Package using Minitab 12 and the others parameters were descriptive analysis. Least Significant Difference(LSD) test was employed to test significant differences among treatment means (Steel and Torrie, 1991).

Table 1: Chemical composition of maize (*Zea mays*) and gliricidia (*Gliricidia sepium*) forage

Nutrients	Forages	
	Gliricidia	Maize
Dry matter, %	82.64	85.77
Crude protein, %	22.19	9.91
Crude fiber, %	18.96	37.11
Extract ether, %	3.32	1.08
NFE, %	43.94	40.01
Ash, %	11.62	11.89

3. Results and Discussion

The results of observations of the effect of birth status (parity) and the provision of supplementary forage feed to productivity of goat during observation included dry matter intake, dry matter and organic matter digestibility, mortality during pregnancy, litter size, birth type, and birth weight of the litter

Effect of treatments on feed intake

The effect of parity treatment and supplementation of giliciridia forage on dry matter intake of pre-mating goat is presented in Table 2.

Table 2: Mean values of daily dry matter intake (g/head) during experiment period

Diets	Parity			Mean diet
	PS_1	PS_2	PS_3	
MF	564.81	631.07	704.98	633.62^a
GF	749.00	884.88	871.60	835.16^b
Mean parity	656.91^a	757.98^b	788.29^b	

Rows within mean parity and columns within mean diets with different letters differ significantly ($P<0.05$).

Parity and diet type independently gave a significant effect ($P<0.05$) on dry matter intake. Mean of dry matter intake of goat in the group of first birth (PS_1) was lower than those in the second and third group (PS_2 and PS_3), while second and third group were not different statistically. The values of dry matter intake were 656.91, 757.98 and 788.29 g/head for PS_1, PS_2 and PS_3, respectively. The low intake of PS_1 group compared with PS_2 and PS_3 group due to the age, frame size and live weigh of the goat. This is supported that intake based on the percentage of body weight (data not shown) of the goat three times birth (3.39% of body weight) is significantly higher than the two times birth (2.95% of body weight) and first times birth (2.73% of body weight). The results of this study agree with result of Arora (1995) who stated that dry matter intake is influenced by body weight, environmental temperature, feed digestibility, feed palatability, and nutrient balance in the diet. This can be understood when the amount of dry matter intake is based on the percentage of body weight, the higher the body weight the higher the intake of dry matter, thus the pre-mating PS3 group has reached the maximum body weight.

Type of diet produced significant effect ($P<0.05$) on the dry matter intake. Dry matter intake of goat given gliciridia forage supplementation (GF), 835.16 g/head was higher than goats given maize forage only (MF), 633.62 g/head. This is due to the differences in nutritional quality of feed(see Table 1) and its gastrointestinal tract. Good quality feed especially with low fiber component content will easier for livestock to digest, so its outflow rate in the gastrointestinal tract is faster, leading to elevation in the dry matter intake (Tillman *et al*., 1991). Furthermore, the dry matter intake in goats is influenced by the digestive rate of feed ingredients in the gastrointestinal tract(Tillman *et al*., 1991). Utomo and Soejono (1999) stated thatthe quantity of nutrient intake depends on the amount of dry matter of feed ingredients consumed by livestock and the nutrient content in the feed given. Moreover, Arora (1995) stated that feed intake will increase if the digestaflow increase or feed has high the digestibility and small particle size. The amount of dry matter consumed by a livestock during the day is important, since the ability of a livestock to consume dry matter is a limiting factor to met nutrition's requirement (Sulyono *et al.*, 1975).

Effect of treatments on feed digestibility

The values of feed digestibility of multiparious goat given different diet within different parity are presented in Table 3.

Table 3: Mean values of dry matter and organic matter digestibility during experiment period.

Variabels	Parity			Diets	
	PS1	PS2	PS_3	MF	GF
DMD (%)	65.28	63.39	62.41	62.05[a]	65.46[b]
OMD (%)	63.70	61.74	60.48	60.55	63.45

Dry matter digestibility (DMD) and organic matter digestibility (OMD). Rows within parity and diets with different letters differ significantly (P<0.05)

Goat parity produced non significant effects (P>0.05) on dry matter and organic matter digestibility. Type of diets however had significant effect (P<0.05) on dry matter digestibility and non significant effect (P>0.05) on organic matter digestibility. Dry matter digestibility of GF-goat group (65.46%) was significantly (P<0.05) higher than those MF-goat group (62.05%).

This is due to the differences in nutritional quality of forage (see Table 1), particualarly in protein content. Gliciridia forage as supplement in the current study provided extra protein to the microorganism in the rumen compared to maize forage only, allowing more microorganism available to digest consumed feed. Sutardi (1979), stated that dry matter digestibility is influenced by feed protein content, because each protein source has different solubility and degradation resistance from ruminal microorganism. The digestibility of organic matter also increased as gliciridia forage supplemetation, but the increased of 3% is not signifant statistically. Sutardi (1979), stated that the digestibility of organic matter is an important factor that can determine the value of feed. Each type of ruminant has rumen microbes with different abilities to digest the diets.

Organic material in the digestive tract of livestock includes carbohydrates, proteins, fats, and vitamins. Organic materials contained in the feed are available in the form of soluble and insoluble, therefore insoluble form is necessary to breaking down into soluble substances. Factors that affect the digestibility of organic matter is the content of crude fiber and minerals from the feed material. The digestibility of organic matter is closely related to dry matter digestibility, since a portion of the dry matter consists of organic matter (Ismail, 2011).According to McDonald *et al.* (2002), factors affecting digestibility, ie feed composition, feed treatment, enzyme supplementation in the feed, livestock and feeding level.

Effect treatments on embryo mortality

Data of embryo mortality of goat given maize forage with and without gliricidia forage at the different parity are presented in Table 3.

Table 3: The rate of embryo mortality of experimental goats

Remarks	Parity					
	PS_1		PS_2		PS_3	
	MF	GF	MF	GF	MF	GF
Pregnant(head)	3	8	5	10	7	7
	11		15		14	
	40					
Litters (head)	3	5	4	8	5	4
	8		12		9	
	29					
Mortality (%)	0.00	37.50	20.00	20.00	28.57	42.86
	27.27		20.00		35.71	
	27,50					

Embryo mortality or miscarriage during pregnancy referred to the pregnant-goat that did not deliveringlitters. The results in this study revealed that embryo mortality rate was as many as 11 of 40 pregnantgoats. Based on Table 3 shows that the highest mortality rate was achieved at the PS_3, 35.71% or 5 heads of 14 pregnant goats, while the lowest was in PS_1, 18.75% or 3 mortality of 11 pregnant goats. The value of embryo mortality rate of goats given supplementation with gliricidia (GF) 32,00% was higher than 20.00% of goats feed maize forage only (MF). Embryo mortality rates on a farm can affect the reproductive efficiency of livestock. A higher embryo mortality rate reduces the number of goats delivering the litters. High mortality in PS_3 group given additional gliricidia forage (GF) indicated that high protein diet does not guarantee will be able to maintain pregnancy until birth. This phenomenonmay be due to management and livestock health factors. High physiological activity indicates a burden on the environment that is too high, such as heat stress and metabolic activity in the body that resulted in the lower ability of the goats to maintain the fetus, leading to high embryo mortality rates.

Effect of treatments on litter size

The value of litter size on goat given diet with and without gliricidia forage at maize forage based diet is presented in Table 4.

Table 4: Litter sizeof goats during experiment period.

Remarks	Treatments					
	PS_1		PS_2		PS_3	
	MF	GF	MF	GF	MF	GF
Sum	3	7	5	12	7	4
Total	10		17		11	
Treatments	1,00	1,40	1,25	1,50	1,40	1,00
Status	1,25		1,42		1,22	
Average	1,31					

The litter size produced by the etawah crossbreed goat in this study was 1.31 head with a range of 1-2 individuals or 31.03% giving birth to twins-litters and 68.97% for single litter (Table 4). Litter size in this study generally is categorized as low category, especially compared to the results of research of Murtidjo*et al.* (2011), which obtained litter size number of Bligon goats 1.74 head with 1-2 or 73.81% of twins-litters and 26.19% single-litter, while Rustadi (2008) got 1.47 head of litter size of Bligon goat, and Prayitno (2003) obtained 1.40-1.45 head of litter size of Bligon goat. The results of this study are also lower than the results of research Widi (2002) and Sutimah (2003) who found 1.81 and 1.61-1.82, respectively.

The results also showed that the litter size of multiparous goat (three times of birth) is higher than the litter size of one time giving birth goat and two times giving birth goat. The results of Sodiq and Sadewo (2008) suggested that litter size

of goats is strongly influenced by the parity and frame size of the body. The frame size affects the goat's ability to give birth to the number of litters. Large frame size will result in a larger number of delivering litter. This is related to the genetics, age, live weights and nutritional status of the goats (Doloksaribu *et al*., 2005), environment and micro climates where the animals are located (Hardjosubroto, 1994), feed intake levels. It has been previously reported by Inounu (1996) that feeding with higher nutritional levels at the time of ovulation will increase the amount of ovum being ovulated which may lead to multiple births. In addition, high litter size is closely related to ovulation rate, fertilization, embryo survival (Hulet and Shelton, 1980), age (Ngadiono *et al*., 1983, Subandrio *et al.*, 1986) and other breeding management factors, especially feed. Primaparious goat generally produce single-litter size(Restall, 1991; Wodziscz-Tomaszewska *et al*., 1993). Ngadiono *et al*. (1983) reported that litter size of Etawah cross breed goats from primaparous to multiparous was 1.56; 1.77, 1.90 and 1.40, respectively.

Effect of treatments on birth weight and birth type of the litters

The effect of parity treatment with gliricidia forage supplementation on birth weight and birth type of young litters of etawah crossbreed goats are presented in Tables 5 and 6.

Table 5: Mean litter birth weight of the litters during the study

Diets	Parity		
	PS_1	PS_2	PS_3
MF	$2,22^{b}$	$2,08^{b}$	$1,45^{c}$
GF	$1,96b^{c}$	$2,43^{a}$	$2,86^{a}$

Rows with different letters differ significantly (P<0.05)

Overall research results produced the average birth weight is 2.17 ± 0.68 is lower than the study of Sutama *et al*. (1993), which states that the average litter birth weight of etawah crossbreed goat is 3.71 ± 0.89 kg. Some previous results were 3.3 kg (Adriani, 2014), 2. 95 kg (Kaunang *et al*., 2012), 3.02 kg (Adhianto *et al*., 2012), 3.58 kg (Kostaman and Sutama, 2006). However the current result was higher than study of Mahmelia and Elieser (2008), reported the value of 2.08 ± 0.54 kg for Boer goat and Kacang goat, respectively. This difference is thought to be due to genetic differences in livestock, goat condition and goat age. According to Adhianto *et al*. (2012) that goat birth weight is strongly influenced by livestock, parent age, litter size and goat breeding management.

Devendra and Burns (1994) stated that the diversity of birth weight is caused by genetic and environmental factors, whereas the diversity of live weights is partly due to breed differences, number of the litter, feed and genotypical phenotype interactions. Genetic factors are potentials or abilities possessed by livestock, whereas environmental factors are an opportunity obtained by livestock in different places.

There was an interaction (P <0.05) between parity and feed treatment independently, but the parity status independently produced no significant effect (P> 0.05) on birth weight of the litter. The birth weight of 2.86 kg from the goat that gave birth three times and given the gliciridia forage was not different from the birth weight of 2.43 kg from the goat that gave birth twice and was given gliciridia forage. The high birthweight of goatsthat given birth more than once and received an additional diet of gamal forage is closely related to the experience of pregnancy and nutrients intake of goat.

Table 6: Litter size of experiment goat

Diets	PS1		PS2		PS3		Total	
	Single	Twins	Single	Twin	Single	Twin	Single	Twin
MF	3	-	3	1	3	2	9	3
GF	3	2	4	4	4	-	11	6
Total	6	2	7	5	7	2	20	9

In addition to nutritional intake, birth weight is also influenced by the type of birth. Based on Table6, it is seen that the birth type in this study found that nine goats that gave birth to twins-litters were lower than single-litter type, ie 20 single-birth. Birth weight of the litters based on the birth type found that the single-litter weight of 2.41 kg was significantly higher than birth weight of twins-litter 0f 1.64 kg.

4. Conclusion

There is no interaction between parity and supplemental feeding of gliciridiaon feed intake, dry matter digestibility and digestibility organic matter, but there is an interaction of birth weight of the litter. Multiparous (twice birth) goat had higher of the conception rate, twinslitter, litters size, with lower embryo mortality compared with the goat delivered litter at one and three times.

Supplementation with gliciridia increased feed intake and digestibility of dry matter, pregnant rate and birth weight of the litters. It also improved the conception rate, twin births, and litter size, but the rate of embryo mortality is higher when compared with the provision of maize forage as a single diet.

References

[1] Adhianto, K., N. Ngadiyono, Kustantinah dan I.G. S.Budisatria. 2012. Lama Kebuntingan, Litter Size, dan Bobot Lahir Kambing Boerawa pada Pemeliharaan Pedesaan di Kecamatan Gisting Tanggamus. Jurnal Penelitian Pertanian Terapan,12(2):131-136.
[2] Adriani, 2014. Bobot lahir dan pertumbuhan anak kambing peranakan etawah sampai lepas sapih berdasarkan *litter zise* dan jenis kelamin. Jurnal Penelitian Universitas Jambi Seri Sains., 16 (2): 51-58
[3] Devendra, C. and G.B. Mc.Leroy, 1982. Goat and Sheep Production in The Tropics. Longman Group. London, pp 61-67.
[4] Devendra, C. dan M. Burns, 1994. Produksi Kambing di Daerah Tropis. Institut Teknologi Bandung, Bandung.
[5] Doloksaribu, M., S. Elieser, F. Mahmilia, dan F.A. Pamungkas. 2005. Produktivitas kambing Kacang pada kondisi dikandangkan: 1. Bobot lahir, bobot sapih, jumlah anak sekelahiran dan daya hidup anak prasapih.

Prosiding. Seminar Nasional Teknologi Peternakan dan Veteriner. Bogor.
[6] Gall, C. 1981. Goat Production. Academic Press Inc. London
[7] Handiwirawan, E., B.Setiadidan D. Anggaeni. 1996. Seminar Nasional Peternakan dan Veteriner. Pusat Penelitian dan Pengembangan Peternakan Produktivitas Induk Ternak Ruminansia Kecil pada Kondisi Peternakan Rakyat di Kabupaten Lebak. In: Prosiding Badan Litbang Pertanian. Deptan. Bogor.
[8] Harjosubroto, W. 1994. Aplikasi Pemuliabiakan Ternak di Lapangan. PT. Grasindo, Jakarta.
[9] Hulet, C.V . and M. Shelton . 1980. Sheep and Goat In : E.S.E . Hafez (Ed.) . Reproduction in Farm Animals .4th Ed. Lea & Febiger, Philadelphia.
[10] Inounu, I. 1996. Keragaan produksi ternak domba prolifik. Disertasi. Pasca Sarjana Institut Pertanian Bogor, Bogor.
[11] Ismail, R., 2011. Kecernaan In Vitro, http://rismanismail2.wordpress.com/ 2011/05/22/nilai-kecernaan-part-4/#more-310. [Rabu, 13 Februari 2016].
[12] Kaunang. D. Siyadi dan S. Wahjuningsih. 2012. Analisis Litter Size, Bobot Lahir dan Bobot Sapih Hasil Perkawinan Kawin Alami dan Inseminasi Buatan Kambing Boer dan Peranakan Etwah. Jurnal Ilmu-ilmu Peternakan, 23(3):41-46.
[13] Kostaman T dan I.K Sutama. 2006. Korelasi Bobot Induk dengan Lama Bunting, Litter Size, dan bobot lahir Anak Kambing Peranakan Etawah. Makalah Seminar Nasional Teknologi Peternakan dan Veteriner. Bogor.
[14] Mahmelia. F. dan S. Elieser. 2008. Korelasi Lama Bunting dengan Bobot Lahir, Litter Size dan Daya Hidup Kambing BOERKA-1. Seminar Nasional Teknologi Peternakan dan Veteriner. Bogor.
[15] McDonald, P.,R.A. Edwards, J. Greenhalgh, and C. Morgan. 2002. Animal Nutrition. 6th Edition. Longman Scientific & Technical, New York.
[16] Murdjito, G., I Gede Suparta Budisatria, Panjono, Nono Ngadiyono, dan Endang Baliarti, 2011. Kinerja kambing bligon yang dipelihara peternak di desa giri sekar, panggang, gunung kidul.Buletin Peternakan, 35(2): 86-95
[17] Ngadiono, N., P. Basuki, dan G. Murdjito. 1983. Beberapa data perfonnans ternak kambing yang dipelihara secara tradisional di pedesaan sejak lahir sampai dengan umur disapih . Pros . Domba dan Kambing di Indonesia. Pusat Penelitian dan Pergembangan Peternakan, Badan Litbang, Departemen Pertanian, Bogor pp. 122-125.
[18] Restall, B.J . 1991 . Goat production in The Asian humid tropics. Proc. Int. Seminar. Thailand .
[19] Rustadi, A.M. 2008. Kinerja induk kambing Bligon di Kecamatan Jogonalan Kabupaten Klaten Jawa Tengah. . Fakultas Peternakan, Universitas Gadjah Mada, Yogyakarta.
[20] Setiadi, B dan P.Sitorus. 1984. Penampilan Reproduksi dan Produksi Kambing Peranakan Etawah. In: Prosiding Pertemuan Ilmiah Penelitian Ruminansia Kecil Domba dan Kambing di Indonesia. Pusat Penelitian dan Pengembangan Peternakan. Bogor.
[21] Setiadi, B. M.Subandriyo, D. Martawidjaja, D. Priyanto, T. Yulistiani, B. Sartika, K. Tiesnamurti, K. Diwyanto Dan L. Praharani. 2001. Karakterisasi kambing lokal dan upaya mempertahankan keanekaragaman sumberdaya genetik. Kumpulan Hasil-Hasil Penelitian Peternakan APBN Tahun Anggaran 1999/2000. Balai Penelitian Ternak. Puslitbang Peternakan, Bogor. pp. 188 – 214.
[22] Sodiq, A dan Sadewo. 2008. Reproduc-tive performance and preweaning mortality of Peranakan Etawa goat under production system of goat farming group in Gumelar Banyu-mas. Animal Production, 10(2):67-72
[23] Sodiq, A., 2010. Pola Usaha Peternakan Kambing dan Kinerja Produktivitasnya di Wilayah Eks-Karesidenen Banyumas Jawa-Tengah. Agripet, 10(2): 1-8
[24] Steel R.G.D and J.H. Torrie. 1991 Principle and Procedure Statistics 2nd Edition. McGraw-Hill Book Co, Inc, Singapore.
[25] Subandrio, B. Setiadi, and P. Sitorus. 1986 . Ovulation rate and litter size ofIndonesian goats. Proc . 5th Int. Conf Livestock Prod . and Deseases in The Tropic. Kuala Lumpur, Malaysia . pp. : 53-54.
[26] Sumediana, I., S. Wuwuh dan B. Sutiyono. 2000. Produktivitas Induk Domba Ekor Gemuk dan Domba Ekor Tipis Berdasarkan Total Bobot Lahir,Total Bobot Sapih, *Litter Size* dan Daya Hidup Anak. Pros. Seminar Nasional Peternakan dan Veteriner. Bogor, 18–19 Oktober 1999. Puslitbang Peternakan, Bogor.
[27] Sutama, I-K., I.G.M. Budiarsana, I-W. Mathius, dan E. Juarini. 1993. Pertumbuhan dan perkembangan anak kambing Pernakan Etawah dari induk dengan tingkat produksi susu yang berbeda. Jurnal Ilmu Ternak dan Veteriner, 4: 95-100.
[28] Sutardi, T. 1979. Ketahanan protein bahan makanan terhadap degradasi mikroba rumen dan manfaatnya bagi peningkatan produktivitas ternak. Prosiding Seminar Penelitian dan Penunjang Peternakan. LPP Institut Pertanian Bogor, Bogor.
[29] Sutimah. 2003. Kinerja induk kambing pada ketinggian lokasi yang berbeda di Kabupaten Kulon Progo Daerah Istimewa Yogyakarta. Fakultas Peternakan Universitas Gadjah Mada. Yogyakarta.
[30] Syuman, M.A. 2010. Factors affecting pre-weaning kids mortality in South African Anggora. South African Journal of Animal, 40(1):54-64
[31] Widi, T.S.M. 2002. Kinerja induk kambing dan domba pada tiga zona agro yang berbeda. Tesis. Program Pasca Sarjana, Universitas Gadjah Mada, Yogyakarta
[32] Wodzicka-Tomaszewska, M. and M. Mastika, 1993 . Effects of feeding molasses-urea blocks on growth rate and onset of puberty in Ettawa-cross goats. In : Advances in Small Ruminant Research in Indonesia. Proceeding Workshop, Ciawi-Bogor, Indonesia, August 3-4, 1993.pp. 213-219