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Performances Holstein Frisien (FH) dairy Cow in different agricultural ecosystem

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Abstract. This research was about the performance Friesian Holland dairy cow in different agricural ecosystems inIndonesia. The objective of research was to study growth performance, body weight and milk production FH in Indonesia. The method of the research was survey method, with the technique of determining farmers proportionally.Sampling farmers and their livestock by random sampling method. The data was processed using SPSS 22.0 for the simple descriptive analysis and then tested statistically used T-Test. The results it was concluded that growth, body weight, and milk yield of dairy cows were influenced by agroecosystems, in the dry land agroecosystems and located on or adjacent to forests (dryland and tropical forest/AES DL-Forest), productivity of dairy cows was better than irrigated and dry land with wide balanced rice agroecosystems (DL-IRF) and rainfed and dry land agroecosystems (AES DL-Rainfed).

1. Introduction

The height of the location of the dairy cattle farm can affect the dairy cattle performance. Now a days, in Kabupaten Garut the general dairy cattle are breed in dry land plateau agricultural ecosystem that are adjoined to tropical forest, dry lands around horticultural farm, and lowland rice field agricultural ecosystem. Horticultural region in Indonesia is a mix of intensive farming system in the agroecosystems of upland in the plateau [1]. In mixed farming systems, the role of livestock, especially ruminants (dairy cow) is crucial and integral part of the production system [2]. Energy input may have been overestimated due to an overestimation of intake of forage, of digestibility of forage, of digestibility of supplement, or a combination thereof. The digestibility of concentrates is fairly rapid and consistent [3].

Type of forage and forage supply system in agroecosystem of highland was different from those in lowland depends on the cropping pattern availability of grass and legume in each region [4]. In the same type of grass, the quality of feed in the highlands is better than in the lowland, because the higher the air temperature will be influence to the stem and to leaves ratio. The difference agroecosystem will lead to differences in the rate of growth and weight of livestock and milk production in dairy cows.

The milk production of cows correlates with their body condition. Body condition scoring is a widely recommended method of evaluating the nutritional management of dairy cows. When the milk production peaks and the energy requirements exceed its intake, the cows go into the negative energy balance (NEB) when they mobilize their lipid reserves, getting thinner, and lose their body condition score (BCS) [5-7]. Horan et al. reported that cows with lower milk yield had shown a higher BCS level during the entire monitored period (calving to BCS nadir) [8]. The conflicting results of the different studies demonstrate the complex relationships among nutritional management, parity, breed, production

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level and reproductive performance [9]. The yields and performance of dairy cows under heat stress conditions are always reduced [10,11].

2. Materials and methods

This research was carried out in three different agricultural ecosystems i.e. Lebakjaya village, with the dry lands and rainfed (AES DL-Rainfed) as the agroecosystem; Cintanagara village with the dry lands and irrigated rice field (AES DL-IRF) in equal extent as the agroecosystem; Pamalayan village with dry lands tropical forest (AES DL-Forest). It was carried out from July, 2014 until December, 2014. The material used in this research was lactation FH dairy cows, calf aged 3 and 6 months, then heifers aged 12 and 18 months. The cow belong to the farmer of Bayongbong Cooperative Garut regency in the three agroecosystem areas, namely: 1. AES DL-Rainfed as many as 44 lactation cows (each age periode each 15 heads, total 60 heads), 2. AES DL-IRF as many as 120 heads (each age periode each 15 heads, total 60 heads) and 3. AES DL-Forests as many as 151 heads (each age periode each 15 heads, total 60 heads). The method used in this research is the survey method. Determination of samples of farmers and livestock is carried out purposively, meaning that only farmers whose livestock have complete record data. The examined variables was: feed consumption, body weight, milk yield, and daily gain. After the data was obtained from the field, then the results of the data were inputted and processed using SPSS version 22.0 for descriptive analysis and then performed T-test student statistics.

3. Results and discussion

3.1. The performance of growth FH dairy cows

The discussion of the performance of growth in FH dairy cows in this study was carried out on calf weight at 1 month old, body weight at 6 months, body weight for cattle aged 12 months and 18 months. The high weight gain of each dairy cow shows a rapid growth rate. The results of the measurement of the average body weight of female FH dairy cattle in the three agroecosystems are listed in Table 1.

No. Month		Avarage of Body Weight	(kg)	
INO.	Monui	AES DL-Rainfed	AES DL-IRF	AES DL-Forest
1.	1	$51,40 \pm 8,60^{a}$	$53,10 \pm 6,12^{a}$	$54,\!80\pm2,\!70^{\mathrm{a}}$
2.	6	$149,50 \pm 11,46^{a}$	$144,00 \pm 8,38^{\rm a}$	$147,47 \pm 15,03^{a}$
3.	12	$220,45 \pm 22,53^{a}$	$239,27 \pm 18,48^{b}$	$252,07 \pm 12,97^{\circ}$
4.	18	$294,\!10\pm 16,\!30^{\rm a}$	$309,60 \pm 57.98^{ab}$	$322,13 \pm 11,83^{b}$

Table 1. The avarage of body weight of female FH dairy cows in different agroecosystem.

Note: The same lowercase towards rows means no significant difference.

The average of body weight of one month female calves (Table 1) each other is not significantly different. There is no difference in the average value of female calves at one month old in the three agroecosystems generally due to relatively similar milk consumption. According to Morrison milk is the food with the highest nutritional value and is very good for spurring the growth of young cattle [12]. A good calf is a calf that has a body weight at a certain age following a normal growth pattern according to the caracteristic of the breed [13]. The average of body weight of 6 months calves based on the statistical test results are no significant. The average consumption for dry matter (BK) in each region is sufficient compared to the dry matter needed during the 6 month calf growth period. The results of Talib et al. at the Livestock Breeding Center, Baturraden-Central Java, found that the female calves at 6 months old was 146.17 kg [14].

There is no significant in body weight, due to the relatively similar feeding management system. The average consumption of croud protein (CP) and energy (TDN) proteins in LK-Forest AES (Table 2) is higher than in the other two AES.

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NT			Research Location			
NO.	No. Feed Ingredients		AES DL-Rainfed	AES DL-IRF	AES DL-Forest	
1.	Rice straw	kg	6,30	-	-	
2.	Grass	kg	-	8,87	9,20	
3.	Consentrat	kg	0,55	0,60	0,60	
4.	Tofu waste	kg	2,50	-	-	
5.	Consumption :					
	- Dry Matter	kg	3,20	2,77	2,85	
	- Crude Protein	kg	0,22	0,31	0,31	
	- TDN	kg	1,73	1,59	1,66	
6.	Needs : 1)					
	- Dry Matter	kg	2,30-3,10	2,30-3,10	2,30-3,10	
	- Crude Protein	kg	0,313-0,387	0,313-0,387	0,313-0,387	
	- TDN	kg	1,64-2,03	1,64-2,03	1,64-2,03	

Table 2. The Average of fee	l consumption per day in	n different Agroecosystem
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Note: The sum of nutrition consumed was calculated based on proximate analysis in Laboratorium Nutrisi Ternak Ruminansia dan Kimia Makanan Ternak Laboratory of Fakultas Peternakan Universitas Padjadjaran (2014) ; The needs of nutrition was calculated based on Table of Needs in Sutardi, T [15] ; *DM:* Dry Matter ; *CP :* Crude Protein; TDN: Total Digestible Nutrient.

The difference in average body weight of heifers aged 12 months was due to the effect of different feeding in the three study region. The average consumption (Table 3) for dry matter (DM) in each region is sufficient compared to the needs of dry ingredients needed during the growth period of 12 month old heifers. But for consumption of crude protein (CP) at AES LK-STH it is lower than its needs, while for TDN consumption in all three AES has been sufficient. Overall, the body weight that can be achieved by 12 month heifers can be said to have shown good performance so that heifers cows are quite feasible to develop at the small holder farm.

No	Food Ingradiants		Research Location			
INO.	reed ingredients		AES DL-Rainfed	AES DL-IRF	AES DL-Forest	
1.	Rice straw	Kg	15,20	-	-	
2.	Grass	Kg	-	18,53	13,87	
3.	King grass	Kg	-	-	5,13	
4.	Consentrat	Kg	-	0,67	0,53	
5.	Tofu waste	Kg	2,60	-	-	
6.	Consumption :					
	- Dry Matter	Kg	5,99	5,24	5,07	
	- Crude Protein	Kg	0,31	0,57	0,56	
	- TDN	Kg	2,93	2,95	2,95	
7.	Needs : 1)	-				
	- Dry Matter	Kg	4,9-7,2	4,9-7,2	4,9-7,2	
	- Crude Protein	Kg	0,559-0,699	0,559-0,699	0,559-0,699	
	- TDN	Kg	2,94-3,98	2,94-3,98	2,94-3,98	

Table 3. The Average of feed consumption of heifers at 12 months old in different Agroecosystem.

Note: The sum of nutrition consumed was calculated based on proximate analysis in Laboratorium Nutrisi Ternak Ruminansia dan Kimia Makanan Ternak Laboratory of Fakultas Peternakan Universitas Padjadjaran (2014).

Feeding systems in 18-month old cows at AES DL-Forest were carried out by providing better quality feeds so that they showed higher body weight averages compared to AES DL-Rainfed and AES DL-IRF (Table 4).

No	No. Feed Ingredients		Research Location		
INO.			AES DL-Rainfed	AES DL-IRF	AES DL-Forest
1.	Rice straw	Kg	22,40	-	-
2.	Grass	Kg	-	27,27	17,07
3.	King grass	Kg	-	-	10,93
4.	Consentrat	Kg	-	0,67	0,60
5.	Tofu waste	Kg	1,20	-	-
6.	Consumption :				
	- Dry Matter	Kg	8,44	7,23	7,19
	- Crude Protein	Kg	0,39	0,78	0,79
	- TDN	Kg	3,99	4,00	4,22
7.	Needs : 1)				
	- Dry Matter	Kg	7,20-8,30	7,20-8,30	7,20-8,30
	- Crude Protein	Kg	0,669-0,859	0,669-0,859	0,669-0,859
	- TDN	Kg	3,98-4,89	3,98-4,89	3,98-4,89

Table 4. The Average of feed consumption of heifers at 18 months old in different Agroecosystem.

Note: The sum of nutrition consumed was calculated based on proximate analysis in Laboratorium Nutrisi Ternak Ruminansia dan Kimia Makanan Ternak Laboratory of Fakultas Peternakan Universitas Padjadjaran (2014).

Daily gains in the three different agroecosystem regions can be displayed in the form of curves as follows: Figure 1.



Figure 1. Body Weight of 1-18 months dairy cow.

The curves of growth show that body weight in all three AES has continued to increase until the age of 18 months and body weight will remain when the body grows around the age of 5-6 years. The difference in body weight in the three different agroecosystem regions was due to differences in feeding and management of each of the agroecosystems. Daily gain was calculated from the age of 1 month to the age of 18 months divided into growth periods of 1-6 months, 6-12 months, and 12-18 months, listed in Table 5.Based on Table 5, it can be stated that the growth rate of calves age 1-6 months in the three AES is not significantly different. Almost the same rate of growth in the three study areas is likely to be related to the maintenance management system which is also relatively similar, especially in terms of the amount of milk supply, which ranges from 4-5 kg/head/day. The amount of milk consumption is in accordance with the recommended range for calves age 1-6 months of 3.5-4 liters and grass 1-2 kg / head / day [15].

No	Parameter Description	AES DI Dainfed	AES DI IDE	AES DI Forest
190.	Tatameter Description	ALS DL-Rainfed	ALS DL-IKI	ALS DL-Folest
1.	DG aged 1-6 months	$98,10 \pm 15,06$	$90,90 \pm 10,41$	$92,67 \pm 15,85$
2.	DG aged 6-12 months	$70,95 \pm 28,36$	$95,27 \pm 17,72$	$104,\!60\pm20,\!87$
3.	DG aged 12-18 months	$73,\!65 \pm 14,\!20$	$70,33 \pm 61,52$	$70,07 \pm 16,85$
Growt	th rate (kg/head/day)			
4.	1-6 months	$0,65 \pm 0,10^{\rm a}$	$0,\!61\pm 0,\!07^{\mathrm{a}}$	$0,62 \pm 0,11^{a}$
5.	6-12 months	$0{,}39\pm0{,}16^{\mathrm{a}}$	$0,53 \pm 0,10^{ m b}$	$0,58 \pm 0,12^{\mathrm{b}}$
6.	12-18 months	$0,\!41 \pm 0,\!08^{\mathrm{a}}$	$0{,}39\pm0{,}34^{\rm a}$	$0,\!39\pm0,\!10^{\mathrm{a}}$

Table 5. Daily gain and growth rate of FH Dairy Cow in different Agroecosystem.

Note: The same lowercase towards rows means no significant difference.

The growth rate of virgin cattle aged 12-18 months in all three AES turned out to be decreasing. In the 12-18 month age period, livestock enter or have passed the estrus period. According to Sudono heifer can be mated for the first time after the cow is 15 months old and its body size is large enough with a body weight of \pm 275 kg [16]. This is important so that the cows can breed at the age of 2 years.

3.2. Milk yield

The results of the study were about milk production (305 days) per lactation of dairy cows in all three AES (Table 6) with overall milk production totaly $3,643.50 \pm 560.97$. The results of the analysis showed that the average milk production in the three study areas was not significantly different (Table 6). The fact that milk production is not significant in the three agroecosystem region in the study area is due to the similar level of feeding management to meet the needs of both energy and protein. Table 6 shows that the average milk production per dairy cow per lactation in the three agroecosystem areas in Garut district is quite good.

Table 6. The average of milk	yield of FH dairy co	ws in different agroecosystem.
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	Research Location				
Description	AES DL-Rainfed	AES DL-IRF	AES DL-Forest		
Milk Production	$3.667,59 \pm 655,23$	$3.556,73 \pm 514,67$	3.706,17 ± 513,01		
(litrest)	$12,02 \pm 2,15^{a}$	$11,66 \pm 1,69^{a}$	$12,15 \pm 1,68^{a}$		
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Note: The same lowercase towards rows means no significant difference.

The average of milk production is higher when compared to the results of research in various West Java regions, namely Cirebon $3,315.22 \pm 623.25$ kg per lactation, Sumedang $2,873.16 \pm 658.67$ kg per head per lactation, and Subang $2,230.11 \pm 303.26$ kg per head per lactation [17]. Average milk production per cow per day was $3,08 \pm 1,52$ litres in Guruve, $2,76 \pm 1,90$ litres in Marirangwe and $2,64 \pm 2,13$ litres in Nharira-Lancashire schemes [18]. The high milk production is caused partly due to the climate that is quite suitable for living FH dairy cows, the level of animal husbandry in terms of maintenance of dairy cows which is relatively good, and the role of KUD dairy companies and related institutions in conducting intensive counseling and guidance to farmers. Based on the description above, it can be said that in the three different AES it is the area of developing dairy farming in Garut Indonesia.

4. Conclusion

The growth of female calves at the age period of 1 to 6 months and the age of 12 to 18 months in the three agroecosystems in the study area did not significantly, whereas in the ages of 6 to 12 months the growth of female calves in AES DL-IRF and DL-Forest was better (P < 0.05) compared to calves growth in AES DL-Rainfed. While the performance of milk production in the study area showed no significant difference, due to the fulfillment of nutritional adequacy requirements which included the needs of dry matter, crude protein and TDN, although the types of forages and concentrates were somewhat different in each of these agroecosystems.

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