The Lactation Performances and Some Reproductive Traits of Heifers Raised in Different Growth Conditions.

Serap GÖNCÜ[(1)] Murat GÖRGÜLÜ[(1)] Uğur SERBESTER[(1)]

Abstract

In dairy cattle, the success of the heifer rearing is to have great importance in terms of return of investment. Heifers for breeding purpose are to ensure that profitability has given birth to her first calf at age of 22-24 months. However, for this purpose controlled conditions and some special requirements must be provided. Many literature reported that the different growth pattern for optimal heifer raising performances. But it must be quite technical critical threshold value for the get optimum performances in the future. The ideal value of the first calving of Holstein heifer is to 22-24 months of age. But in the practical result did not show these ideal. Many study results showed big variation from 18 months to 36 months of age. This high first calving age affected the animal future performances. Dairy farms must be considering the critical threshold value for the optimum heifer raising program. For this purpose 2010-2013 year are born between 118 head heifer were monitored and recorded during the 3 year study and status from birth to first lactation were evaluated depending on the growth performances. In this study the results of 118 heifer lactations and reproductive performances werw determined.

Keywords: Heifers, growth, lactation, reproduction

Farklı Büyütme Koşullarında Tutulan Siyah Alaca Düvelerin İlk Laktasyon Süt Verimi ve Döl Verim Özellikleri

Abstract

Süt sığırcılığında düve yetiştirme yatırım maliyetlerinin geri dönüşümü açısından çok önemlidir. Damızlık düvelerin işletmelerde 22-24 aylık yaşlarda ilk buzağısını vermesi istenir. Ancak, bunun sağlanması özel büyütme programı ve gereksinmelerinin dönemlerine göre karşılanması ile mümkün olabilir. İdeal düve yetiştirme programı olarak pek çok literatür mevcuttur. Ancak gelecek performanslarında ideal sürü performans değerleri için teknik kritik süreçlerin bilinmesi gerekir. İlkine buzağılama yaşında ideal yaş 22-24 ay olarak kabul edilir. Ancak bu ideal değer için işletme koşularında elde dilen sonuçlar oldukça uzaktır. Pek çok çalışmada 18 ay ile 36 aya kadar değişen sonuçlar yer almaktadır. İlkine buzağılama yaşı ise gelecek verim özellikleri ve performansları etkilemektedir. Bu nedenlerle süt sığırcılığı işletmeleri düve yetiştirme programlarında kritik eşik değerlerini bilerek ve bunları doğru yöneterek başarılı olabilirler. Bu nedenle bu çalışmada 2010-2013 yılları arasında doğan 118 baş dişi buzağının gelişimi ve gerçek verim sonuçları değerlendirilmiştir.

Anahtar kelimeler: Düve, büyütme, laktasyon, döl verimi

Introduction

Heifers are the key basic factor of any dairy enterprise for future performance. Improvement of a herd is possible when culled cows are replaced by well fed, healthy, genetically superior, and properly managed to 2-year-old heifers. Holstein replacement heifers should calve and enter the milking herd at 22 to 24 month of age (Heinrichs and Hargrove, 1987; Crowley et al., 1991). An excellent way to improve herd

Yayın Kuruluna Geliş Tarihi: 07.12.2015
[(1)]Çukurova Üniversitesi Ziraat Fakültesi Zootekni Bölümü, Balcalı, ADANA

production is to mate cows to the best bulls available, then feed and manage replacement heifers so they reach their true potential in an optimal time period. Healthy, productive heifers are the result of good management that starts before the cows are conceived and continues until they enter the milking herd. Monitoring growth and adjusting diets accordingly for their planning performances is the single most important part of a sound dairy heifer program. The general rule is to heifer's growth targets should be 55% of mature weight at breeding and 85 to 90% of mature weight at first calving. Many research studies have shown the positive relationship between body weight at calving and first lactation milk production. Not only are undersized heifers smaller and less productive, but they also are prone to more problems at calving. On the other hand, accelerating the growth of heifers in a manner that causes them to become fat also reduces their lifetime milk production and longevity. Overfeeding concentrates or high-quality forages such as corn silage can cause this condition if heifers are not properly monitored, with intake being restricted and other nutrients adjusted accordingly. Published research studies show that excessive energy intake (140 percent of the recommended amount) before breeding can decrease development of the secretory tissue in the cow's mammary gland and thereby reduce first lactation milk yield (Clark, and Touchberry 1962). It is recommended to grow heifers at 1.8 lbs. /day to achieve optimal milk yields. Feeding below or above this rate has been shown to reduce first lactation milk production. Feeding to achieve accelerated growth rates after breeding does not appear to hinder mammary development. Therefore, we recommend that growth rates after puberty can be 1.5 to 2.5 lbs. /day, based solely on the age and body weight at breeding and the desired body weight at calving. Since there is a great deal of flexibility in ADG post puberty, heifers should be able to reach recommended body weights most of the time. Optimal growth and development are related to energy intake and also can be aided by ensuring that heifers receive an adequate level of protein. Dairy farms must be considering the critical threshold value for the optimum heifer raising program. For this purpose 2010-2013 year are born between 118 head heifer were monitored and recorded during the 3 year study and status from birth to first lactation were evaluated depending on the growth performances.

Materials and methods

In this study, data obtained from reproductive records of 118 heifer birth from 2010 to 2012 to which were raised at the Cukurova University Dairy Research Farm were investigated. A total of 118 heads of heifer fertility and milk yield records were evaluated during 2011-1014. After birth all females weighing and monitored for the performances.

During preweaning period all calves were kept together with their mothers for the first 3 days after calving and then were housed in individual pens in fiberglass calf hutches. All hutches had soil floors with a straw bedded which is commonly used in intensive dairy farm for calf comfort. Calves were fed colostrums as soon as possible, after birth during the 3-day period. Between day 4 and 56, calves were fed with whole milk from a pail twice a day, such that each calf received 212 L whole milk (4 kg per day) over the whole experiment. Calves were also received a commercial calf grower and alfalfa straw ad libitum from first week of the trial to the weaning. Fresh water were supplied to the calf ad libitum in pail after consuming their liquid feeds. After weaning, the calves were kept in the calf hutches for a further 8 weeks period of the experiment. During the post-weaning period (8-16 weeks), calves were fed a total mixed ration ad libitum containing 40% of calf grower and 60% of alfalfa hay grounded to 1–2 cm lengths. After weaning calves were allocated the experimental groups which were fed live weight gained high (>700 g/day +) as first group and low (<700 g/day) as second group. Low performance group calves were fed 0.5-1 kg calf grower and with corn silage for freely and the high

performance group calves were fed free corn silage and 1.5-2 kg calf grower. Dairy heifer feeding program, TMR was used consisting was to 10 kg of corn silage + legumes (vetch or triticale) silage, 1 kg of alfalfa, 1 kg wheat straw and 3 kg concantrate. The chemical composition of calf starter and alfalfa hay is given in Table 1. The dry matter, crude protein, ash, ether extract and crude fiber contents of feeds were determined according to the standard AOAC procedures (1998). NDF and ADF were analyzed using the methods of Van Soest et al. (1991) with ANKOM fiber analyzer.

Table 1-Chemical compositions of calf starter, calf grower and alfalfa hay

Chemical composition (%, as fed basis)	Calf starter	Calf grower	Alfalfa hay
Dry matter	93.76	92.33	93.14
Crude protein	15.98	16.85	11.4
Ether extract	4.12	4.55	0.8
Crude fiber	9.60	9.53	34.43
ADF	11.51	10.25	39.23
NDF	22.23	23.94	45.32
Ash	7.67	73.80	7.23

Animals are taken to the dairy farm normal heifer rearing management till 250 kg live weight and all the experimental groups were fed the same feed feeding programs of the farms. During the all this period weight gain of the heifer were taken monthly interval. These feeding sysytem continued until the end of pregnancy and during the last one month has TMR were changed to the concantrate. In the last month of pregnancy, 10 kg of corn silage or triticale + vetch silage, 1 kg alfalfa hay and 1 kg wheat straw and 5-6 kg of concentrate were used as feed source. During the lactation corresponding to 2.5 kg of milk yield for shareholders is given 1 kg of concentrate feed. During the studies heifers were kept in shelters which is ground floor area. Artificial insemination is used for all cows during all season. To aid in estrus detection, Kamar heat detection devices (Kamar, Steamboat Springs, Colorado, USA) were placed on the tail head of all heifers four times a day (06:00, 10:00, and 13:00, 18:00 h), and observed for estrus behavior. As reproductive traits in the study; first breeding age, first calving age, the number of insemination per pregnancy, calving rate, the first insemination were examined. Animals were milked automatically at 05:00 in the morning and at 17:00 in the afternoon. And milk recording were taken daily interwal. Milk production is to sum of daily milk production of the heifers. Animal housed and maintained in the study according to the approval of animal care and use Ethical Committe of Cukurova University. The study was carried out in a completely randomised design and data were analysed SPSS statistical program.

Results and Discussion

110 heifers calved, and 8 heifers were died prior to parturition because of disease problem (heifers fed on low performance= 3; heifers fed on high performance = 5). All the rest of heifers reproductive and milk performance parameters were summarized Table 2. As expected that the groups average daily weight gain differences between the experimental groups during prepuberty period is determined statistically different ($P<0.01$). During this perod, body condition score values differences between the

groups is also determined statistically different (P<0.01).

Table 2. The reproductive and milk perfromance parameters of low and high perfromance of experimental groups.

	Low perfomance			High perfromance			P<
	Average	Min.	Max.	Average	Min.	Max.	
Prepuberty Performance							
Birth weight (kg)	36.00±0.65	29.00	43.00	37.23±.75	33.00	43.00	0.22
weaning weight (kg)	73.50±1.28	64.00	88.00	75.65±2.14	62.00	98.00	0.37
Daily weight gain (kg/day)	0.51±0.01	0.27	0.62	0.74±0.01	0.63	0.87	0.00
Body Condition Score	3.20±.049	2.75	3.50	3.53±.038	3.25	3.75	0.01
Reproduction parameters							
First oestsrus age (Month)	11.82±0.28	11.02	14.03	9.70±0.38	7.11	13.44	0.00
First Insemination Age (Month)	24.54±.58	19.41	39.38	20.27±0.56	16.62	41.18	.000
First İnsemination weight (kg)	365.67± 13.11	345.00	390.00	375.61±4.40	350.00	405.00	0.49
İnsemination per pregnancy (times/pregnancy)	2.17±.15	1.00	5.00	2.38±.14	1.00	6.00	.321
First Calving Age (Month)	32.83±0.34	30.62	39.93	28.10±0.18	25.70	30.49	.000
Milk performance							
First Lactation Milk Yield (kg)	7191.95±270.09	2925	9924	6430.45±151.26	3392	9119	.010
Lactation period (day)	317.41±16.77	143	652	339.13±9.44	235	532	.233

First oestrus of the calves were observed around 11.82±0.28 months of age of low performance group while high performences group first oestrus age is to determined as 9.70±0.38 months of age. The differences between the groups is also determined statistically different (P<0.01). Age at puberty depends on genetics and weight. This age is important for heifer calf production and lactation performance. Lifetime profit of dairy replacement heifers is maximized when heifers calve between 23 and 25 months of age (Head, 1992). Puberty is defined as the time when the heifer has her first ovulation. Following the first ovulation, the heifer should begin to have heat periods on a continual basis, typically every 21 days. The age at which heifers have their first heat or reach puberty determines when the heifer is bred the first time. Delays in reaching puberty will in turn delay age at first breeding and delay age at which the heifer calves. Optimally, the Holstein heifer should reach puberty at 9 to 10 months of age, begin cycling on a typical basis, and have her first insemination at 14 to 15 months of age to calve at 23 to 24 months (Heinrichs ve Hargrove, 1987). High perfromance groups showed acceptable first oestrus age (9.70±0.38) while low

performance group first oetsrus age (11.82±0.28) is higher than the accapteble level (9 to 10 months of age).

The first calving age of low performance group was determined as 32.83±0.34 months of age (min. 30.62 months and max. 39.93 month) while high performance group values were 28.10±0.18 months of age (min. 25.70 months and max. 30.9 month). These results were similar with 887.07, 900.5 ve 933.20 day findings of researchers (Bakır et al, 1994; Kumlu et al., 1991) and other 861.10, 865.9 and 880 day values of researchers (Mangurkar et al., 1987; Shrinivas and Govindalah, 1997).

Pursley et al. (1997) have reported that the pregnancy rates were 74.4% in heifers and 38.9% in cows following artificial insemination after spontaneous estrous behavior. In present study, the pregnancy rates of heifers in high and low perfromance groups were observed similar respectively. Because there were no significant differences in the number of services per conception between the groups of heifers (2.17 ± 0.15and 2.38 ± 0.14, respectively). The values similar with results of (Kumlu and Akman 1999; Akman et al. 2001; Özcan and Altınel, 1995) who reports were, 2.1, 2.23 and 2.4 and results of (Al-Salman, 1985; Lee et al, 1989; Gyawu et al., 1990; Reyes, 1988) who report as 2.6, 3.4, 2.04, 2.5 insemination per conception. Also our results higher that the result of Kumuk (1989); Alpan and Arıtan (1970); Gyawu et al. (1990) who report 1.5 insemination per conception.

But there is a critical growth occured around this period which is mostly affected lactation perfromances of the replacement heifers. This is also critical period aspect of udder development. Udder development begins at about 3 months of age and ends at puberty or approximately 9 to 10 months of age (Cowie, A.T., 1949). This is referred to as the allometric period of mammary growth. During this period, udder growth and development is 3.5 times that of other body systems. Studies indicate that when overconditioning during this period occurs, mammary secretory or milk producing tissue in the udder is greatly reduced and replaced with fat (Sinha and Tucker, 1969). Temporary periods of rapid gain after puberty are acceptable and may allow compensatory adjustments for weight gain to our target at 24 months and weighing 1350 pounds the day of calving. However, average daily gains should be limited to not exceed 1.7 lbs. per day during this 3 to 9 months of age period.

First lactation milk yield of low performance group was determined as 7191.95±270.09 kg of age (min. 2925.00 kg and max. 9924.00 kg) while high performance group values were 6430.45±151.26 kg (min. 3392.00 kg and max. 9119.00 kg). The differences between the groups is to determined statisticaly significant ($P<0.01$). Milk yield of the heifers were higher than the similar with 5600 kg, 5087,5 kg ve 4583,776 kg findings of researchers (Akman et al, 2008; Duru and Tuncel, 2004; Soylu, 1994) and other 5209 kg, and 4966,1 kg values of researcherrs (Kumuk,1989 and Özçelik 1994). The lactation period of low performance group was determined as 317.41±16.77 day (min. 143.00 day and max. 652.00 day) while high performance group values were 339.13±9.44 day (min. 235.00 day and max. 532.00 day). The differences between the lacation period of the groups is not determined statisticaly significant ($P>0.05$).

Sejrsen et al. (1982) reported that the ad libitum feeding during prepuberty lowered mammary secretory tissue weights 23% and deoxyribonucleic acid content 32% compared to restrict feeding. In contrast, there was no difference in growth of mammary secretory tissue between postpubertal heifers fed restricted or ad libitum amounts. Composition of mammary parenchyma was not affected by plane of nutrition in prepubertal or postpubertal heifers. From these data, we suggest a critical period for total mammary cell number in heifers during which mammary growth is affected adversely by a high plane of nutrition.

Sejrsen and Purup (1997) reported that the negative effect of high average daily gain on milk

production at first lactation while other in which no effect was found (Pirlo et al. 1997; Waldo et al. 1998). Also Van Amburgh et al. 1998 reported that the nutrition effect was observed with average daily gain over 1.0 kg. Abeni et al. (2000) reported that the late calving heifers had higher milk production and a lower fat milk percentage than early calving heifers.

Gardner et al. (1977) groups of heifers have been applied to an accelerated growth study gaining 2.4 pounds per day after puberty and freshening at 19.7 months of age. Compared to heifers calving at 26.9 months of age, the milk yields were significantly lower in the accelerated group, but there were no differences in the second lactation milk yield.

Choi et al. (1997) carried out a study which is heifer fed according to a schedule of 3, 2, 4, 2, 5 and 2 mo in which feed intake was alternately 20% below or 25% above requirements. And results showed that the first estrus, first conception, gestation period, services per conception, and calving difficulty (dystocia) were not affected by stair-step growth. These results indicate that compensatory growth can contribute to the improvement of growth efficiency and lactation performance. In the bovine, postnatal mammary growth occurs at an allometric rate prior to puberty and returns to an isometric rate after puberty (Sinha and Tucker, 1969). It is well documented that elevated nutrient intake during this allometric growth phase results in reduced parenchymal (PAR) mass and DNA (Sejrsen et al., 1978;1982; Petitclerc et al., 1999; Capuco et al., 1995). Several hypotheses have been proposed to explain this mechnanism.

Conslusion

Many studies on the effect of weight and age at first calving on subsequent milk yields have been carried out. There is a wide variation between the results of the researchers. The first lactation milk yield of these study is higher but variations is also higher. First lactation milk yield of low performance group was determined as 7191.95±270.09 kg while high performance group values were 6430.45±151.26 kg. The differences between the groups is to determined statisticaly significant ($P<0.01$).

Acknowledgements

The authors thank the staff of the Research and Application Farm of Çukurova University, Agricultural Faculty for their technical contribution and also the Scientific Research Fund of Çukurova University for financial support under project number ZF2013YL53.

Literature

Abeni,F. ,Calamari, L., Stefanini, L., and Pirlo, G. 2000. Effects of Daily Gain in Pre- and Postpubertal Replacement Dairy Heifers on Body Condition Score, Body Size, Metabolic Profile, and Future Milk Production . J Dairy Sci 83:1468–1478

Akman, N., Tuncel, E., Yener, M., Kumlu, S., Özkütük, K., Tüzemen, N., Yanar, M., Koç, A., Şahin, O., Kaya, Ç.Y., 2008. Türkiye'de Sığır Yetiştiriciliği. Erişim Tarihi 30.03.2008 http://www.zmo.org.tr/etkinlikler/6tk05/033 numanakman.pdf

Akman, N., Ulutaş, Z., Efil, H., Biçer. S., 2001. Gelemen Tarım İşletmesinde Yetiştirilen Siyah Alaca Sürüsünde Süt ve Döl Verim Özellikleri. Atatürk Üniv. Ziraat Fak. Derg. 32 (2), 173-179.

Alpan, O., Arıtan, N. 1970. Karacabey Harasında On Yıllık Holstein yetiştiriciliği Üzerine Araştırmalar. III. Süt Verimi Özellikleri. Lalahan Zootekni Araştırma Enstitüsü Dergisi Cilt:10, Sayı:4:14-15.

Al-Salman, M.H., 1985. Genetic Relationships of Reproductive Performance and Production of Holstein Cattle. University of Arkansas, U.S.A. Dissertation Abst. Inter. 45 (11): 3419.

AOAC 1998. Official Methods of Analysis. Association of Official Analytical Chemists, Arlington, VA.

Bakır, G., Kaygısız, A., Yener, S.M., 1994. Ankara Şeker Fabrikası Çiftliğinde Yetiştirilen Siyah Alaca Sığırların Döl Verim Özellikleri. Tr. J. Vet. and Anim. Sci. 18: 107-111.

Capuco, A. V., J. J. Smith, D. R. Waldo, and C. E. Rexroad. 1995. Influence of prepubertal dietary regimen on mammary growth of Holstein heifers. J. Dairy Sci. 78:2709–2725.

Choi, YJ1, Han IK, Woo JH, Lee HJ, Jang K, Myung KH, Kim YS.1997. Compensatory growth in dairy heifers: the effect of a compensatory growth pattern on growth rate and lactation performance. J Dairy Sci. 1997 Mar;80(3):519-24.

Cowie, A.T., 1949. The relative growth of the mammary gland in normal, gonadec-tomized, and adrenalectomized rats. J. Endocrinol. 1949;6:145.

Duru, S., Tuncel, E.,2004. Siyah Alaca Sığırlarda Kuruda Kalma Süresi, Servis Periyodu ve İlkine Buzağılama Yaşı ile Bazı Süt Verim Özellikleri Arasındaki İlişkiler. Uld.Ün.Zir.Fak.Derg. 2004, 18(1):69-79

Gardner RW, et al: 1977. Accelerated growth and early breeding of Holstein heifers. J Dairy Sci 60:1941-1948, 1977.

Gyawu, P., Asare, K., Karikari, P.K., 1990. The Performance of Imported Holstein Friesian Cattle and Their Progeny in The Humid Tropics. Anim. Breed. Abst. 58: 2654.

Heinrichs A.J, Hargrove G.L., 1987. Standards of weight and height for Holstein heifers. J Dairy Sci. 70:653-660, 1987.

Head, H.H. 1992. Heifers Performance Standards: Rearing Systems, Growth Rates and Lactation, In: Wilcox CJ and VanHorn HH (ed.) Large Dairy Herd Health Management. University of Florida Press, Gainesville, Fl. 1992, pp. 422-433.

Kumlu, S., Pekel, E., Özkütük, K., 1991. Siyah Alaca, İsrail Frizyanı, Kilis ve Melezleri Üzerine Araştırmalar (2. Döl Verim Özellikleri). Çukurova Üniv. Zir. Fak. Dergisi. 6 (1): 155-168.

Kumlu, S., Akman, N., 1999. Türkiye Damızlık Siyah Alaca Sürülerinde Süt ve Döl Verimi. Lalahan Zootekni ve Hayvancılık Araş. Enst. Dergisi. 36 (1): 1-15.

Kumuk, T. 1989. Türkiye'nin Batı Kesiminde Yer Alan ve Siyah Alaca Sığır Yetiştiriciliği Yapılan Bazı Devlet Tarım İşletmelerinin Teknik Analizi (Doktora Tezi). Ege Üniv. Fen Bilimleri Enstitüsü. Zootekni Anabilim Dalı. İzmir.

Lee, H.K., Sin, Y.S., Cho, Y.Y., Ohh, B.K., 1989. Studies On Estimation of Genetic Parameters For Milk Yield Reproductive Performance in Dairy Herds. Anim. Breed. Abst. 57: 5453.

Mangurkar, B.R., Phadnis, Y.P., Chaudhari, Y.V., Pende, A.B., 1987. Lifetime Performance of Imported Holstein Friesian and Jersey Heifers. Anim. Breed. Abst. 55: 1507.

Özcan, M., Altınel, A., 1995. Siyah Alaca Sığırların Yaşama Gücü, Döl Verimi ve Süt Verimi Özelliklerini Etkileyen Bazı Çevresel Faktörler Üzerinde Araştırmalar (2. Süt Verim Özellikleri). İstanbul Üniv. Vet. Fak. Dergisi. 21 (1): 36-48.

Özçelik, M., İç Anadolu Şartlarında Yetiştirilen Holştayn İneklerde Değişik Mevsimlerin Süt ve Döl Verimi Özelliklerine Etkisi. Ankara Üniversitesi Sağlık Bilimleri Enstitüsü Doktora Tezi. 1994

Pirlo, G., Capelletti, M. and Marchetto, G., 1997. Effects of energy and protein allowances in the diets of prepubertal heifers on growth and milk production. J. Dairy Sci. 80:730–739.

Pursley, J.R, Wiltbank, M.C, Stevenson, J.S, Ottobre, J.S, Garverick, H.A, Anderson, L.L., 1997. Pregnancy rates per artificial insemination for cows and heifers inseminated at a synchronized ovulation or synchronized estrus. J Dairy Sci, 80, 295-300,

Reyes, L.A., 1988. Performance of Dairy Cattle According to Calving Season the Mexicali Valley, Lower California. Dairy Science Abst., 60:3129.

Sejrsen, K., and Purup, S., 1997. Influence of prepubertal feeding level on milk yield potential of dairy heifers: A review. J. Anim.Sci. 75:828–835.

Sejrsen, K., Huber, J.T., Tucker, H.A., Akers, R.M.., 1982. Influence of Nutrition on Mammary Development in Pre- and Postpubertal Heifers. Journal of Dairy Science Volume 65, Issue 5, May 1982, Pages 793–800

Shrinivas, J., Govindalah, M.G., 1997. First Lactation Performance of Holstein Friesians in a Private Herd. Anim. Breed. Abst. 66: 1656.Sinha YN, Tucker H. A., 1969. Mammary development and pituitary prolactin level of heifers from birth through puberty and during the estrous cycle. J Dairy Sci 52:507-512, 1969.

Sejrsen, K.,1978. Mammary development and milk yield in relation to growth rate in dairy and dual-purpose heifers. Acta Agric.Scand. 28:41–46.

Sejrsen, K., Purup, S., Vestergaard, M., Weber, M. S., and Knight, C. H.,1999. Growth hormone and mammary development. Domest. Anim. Endocrinol. 17:117–129.

Sinha, Y. N., and Tucker,H. A. 1969. Mammary development and pituitary prolactin level of heifers from birth through puberty and during the estrous cycle. J. Dairy Sci. 52:507–512.

Soylu, İ., 1994. Bir Kamu Tarım İşletmesinde Siyah Alaca Süt Sığırı Sürüsünde Süt ve Döl Verimi Karakteristiklerine İlişkin Genotipik ve Fenotipik Parametreler. Trakya Üniversitesi Fen Bilimleri Estitüsü Yüksek Lisans Tezi, 1994

Van Amburgh, M. E., Galton, D. M., Bauman, D. E., Everett, R.W., Fox, D. G., Chase, L. E., and Erb,H.N., 1998. Effects of three prepubertal body growth rates on performance of Holstein heifers during first lactation. J. Dairy Sci. 81:527–538.

Van Soest P.J., Robertson J.B.,Lewis B.A., 1991. Methods for dietary fiber, neutral detergent fiber, and nonstarch polysaccharides in relation to animal nutrition. Journal of Dairy Science 74: 3583-3597

Waldo, D.R., A.V. Capuco, and Rexroad, Jr. C. E., 1998. Milk production of Holstein heifers fed either alfalfa or corn silage diets at two rates of daily gain. J. Dairy Sci. 81:756–764

Çizelge 1. Diyarbakır il merkezinde satılan farklı sunuş çeşitliliğindeki kahverenkli yumurtaların yumurta kalitesi ve yumurta sarısı kolesterol konsantrasyonları

Renk	Sunuş çeşitliliği	Merkezi eğilim ölçüleri	Ağırlık (g)	Renk skoru	Sarı				Kolesterol (mg/g)
					Ağırlık (g)	Oran (%)	Yükseklik (mm)	Çapı (mm)	
Kahverengi	Konvansiyonel	Ortalama	53.0	7.5	14.4	27.0	12.8	43.4	10.0
		Standart sapma	4.04	1.47	3.0	4.58	2.6	6.7	1.6
		Medyan	52.9	8.0	13.9	27.5	13.4	43.7	9.6
		En az	46.4	5.0	9.8	18.2	9.1	33.4	8.9
		En fazla	61.8	9.0	19.3	35.1	16.7	53.7	15.4
	Serbest yetiştirme	Ortalama	63.4	13.4	17.2	27.2	17.8	40.4	11.6
		Standart sapma	2.37	0.70	1.51	2.45	0.87	1.81	3.02
		Medyan	62.9	13.5	16.8	20.0	17.8	40.5	11.3
		En az	59.4	12.0	15.7	23.8	16.2	38.3	7.82
		En fazla	67.2	14.0	20.0	31.9	18.9	42.8	15.5
	Fonksiyonel	Ortalama	57.8	10.4	14.2	24.6	15.5	39.6	10.3
		Standart sapma	0.60	0.52	1.42	2.41	0.69	1.71	1.22
		Medyan	57.8	10.0	14.2	24.8	15.7	39.4	10.1
		En az	56.9	10.0	10.9	18.9	14.1	37.2	8.4
		En fazla	58.5	11.0	15.9	27.7	16.4	42.5	12.3
	Organik	Ortalama	65.0	10.4	17.2	26.7	18.7	40.9	12.2
		Standart sapma	4.84	0.52	1.13	3.20	1.00	2.01	3.36
		Medyan	65.7	10.0	17.2	25.9	18.7	40.3	11.2
		En az	58.5	10.0	16.1	23.5	17.2	38.7	8.4
		En fazla	71.6	11.0	19.7	33.8	20.4	45.1	17.2

Çizelge 2. Diyarbakır il merkezinde satılan farklı sunuş çeşitliliğindeki beyaz renkli yumurtaların yumurta kalitesi ve yumurta sarısı kolesterol konsantrasyonları

Renk	Sunuş çeşitliliği	Merkezi eğilim ölçüleri	Ağırlık (g)	Renk skoru	Sarı				Kolesterol (mg/g)
					Ağırlık (g)	Oran (%)	Yükseklik (mm)	Çapı (mm)	
Beyaz	Konvansiyonel	Ortalama	51.6	11.7	14.2	27.8	14.1	40.3	10.1
		Standart sapma	5.50	0.81	1.40	2.92	0.92	2.69	2.20
		Medyan	51.9	12.0	14.6	28.1	14.3	40.7	9.6
		En az	41.6	10.0	10.5	20.8	12.7	35.9	8.98
		En fazla	59.7	13.0	16.6	31.5	15.9	44.4	19.3
	Serbest yetiştirme	Ortalama	57.2	13.9	14.1	24.7	18.6	38.1	12.1
		Standart sapma	1.50	0.31	0.53	0.93	0.83	0.84	3.43
		Medyan	57.1	14.0	14.2	24.9	18.6	38.2	10.8
		En az	54.8	13.0	12.9	23.5	17.0	36.6	8.2
		En fazla	59.4	14.0	14.9	26.4	19.9	39.8	16.5
	Fonksiyonel	Ortalama	60.6	11.5	15.7	25.9	17.5	40.6	13.8
		Standart sapma	4.20	2.12	1.24	1.03	0.61	2.60	2.81
		Medyan	60.1	11.0	15.8	25.7	17.8	40.1	14.3
		En az	54.2	9.0	13.1	24.2	16.5	36.8	9.8
		En fazla	67.1	14.0	17.1	28.0	18.2	45.6	17.1
	Organik	Ortalama	61.3	10.4	15.8	25.7	18.7	40.3	11.9
		Standart sapma	6.04	0.52	3.17	2.96	0.64	2.59	3.66
		Medyan	60.2	10.0	14.3	24.4	18.8	39.5	11.4
		En az	52.6	10.0	13.6	22.6	17.8	37.9	7.2
		En fazla	75.3	11.0	22.5	31.5	19.6	45.6	17.3